User Manual

Allen-Bradley

FLEX I/O PROFIBUS Adapter Module

Catalog Number 1794-APBDPV1

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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The information below summarizes the changes to this manual since the last printing.

To help you find new and updated information in this release of the manual, we have included change bars as shown next to this paragraph.

The table below lists the sections that document new features and additional or updated information about existing features.

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Notes:

Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual
- the purpose of this manual
- related documentation
- conventions used in this manual

Who Should Use this Manual

You must be able to program and operate a PROFIBUS product and PROFIBUS network to make efficient use of the FLEX I/O PROFIBUS APBDPV1 adapter module.

We assume you know how to do this in this manual. If you do not, refer to your software user manuals or online help before attempting to use these modules.

Purpose of this Manual

This manual describes how you can use your FLEX I/O PROFIBUS APBDPV1 adapter with your controller. The manual helps you install, program, and troubleshoot your module.

For Information About	See
Overview of the FLEX I/O PROFIBUS APBDPV1 Module	Chapter 1
Communicate With Your Module	Chapter 2
Connect Your Adapter to the PROFIBUS DP Network	Chapter 3
Configure the Adapter for Master/Slave Communication	Chapter 4
Interpret Status Indicators for the FLEX I/O PROFIBUS Module	Chapter 5
Apply FLEX I/O Modules	Chapter 6
Specifications	Appendix A
Device Data Base (GSD) File	Appendix B
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Related Documentation

The following documents contain additional information concerning Rockwell Automation products.

Resource	Description
FLEX I/O Selection Guide, publication 1794-SG002.	A description and overview of the 1794 series FLEX I/O, FLEX I/O XT and FLEX Ex modules and compatible control platforms.
Remote I/O Adapter Module User Manual, publication 1794–UM009.	Information on how to use the Remote I/O Adapter Module Catalog No. 1794-ASB.
Remote I/O Adapter Modules Installation Instructions, publication 1794-IN098.	Information on how to install the Remote I/O Adapter Module Catalog No. 1794-ASB, 1794-ASB2, 1794-ASBK, 1794-ASB2K
FLEX I/O PROFIBUS Adapter Module Installation Instructions, publication 1794-IN087.	Information on how to install the FLEX I/O PROFIBUS Adapter Catalog No. 1794-APB.
FLEX I/O PROFIBUS Adapter Module User Manual, publication 1794-UM057.	Information on how to use the FLEX I/O PROFIBUS Adapter Module Catalog No. 1794-APB.
FLEX I/O Terminal Base Units Installation Instructions, publication 1794-IN092.	Information on how to install the FLEX I/O Terminal Base Units Catalog No. 1794-TB2, 1794-TB3, 1794-TB3K, 1794-TB3S, 1794-TB32, 1794-TB3G, 1794-TB3GK, 1794-TB3GS, 1794-TB3T, 1794-TB3TS, 1794-TBN, 1794-TBNK, 1794-TBNF.
FLEX I/O Digital Input Modules Installation Instructions, publication 1794-IN093.	Information on how to install the FLEX I/O Digital Input Modules Catalog No. 1794-IB8, 1794-IB16, 1794-IB16K, 1794-IB32
FLEX I/O Digital DC Sourcing Input and Sinking Output Modules Installation Instructions, publication 1794-IN095.	Information on how to install the FLEX I/O Digital Input and Output Modules Catalog No. 1794-IV16, 1794-OV16, 1794-OV16P
FLEX I/O Digital DC Sourcing Output Modules Installation Instructions, publication 1794-IN094.	Information on how to install the FLEX I/O Digital DC Sourcing Output Modules Catalog No.1794-OB8, 1794-OB8EP, 1794-OB16, 1794-OB16P, 1794-OB32P
FLEX I/O Input/ Output Module Installation Instructions, publication 1794-IN083.	Information on how to install the FLEX I/O Input and Output Modules Catalog No.1794-IB16XOB16P, 1794-IB10XOB6
FLEX I/O 8 Output Relay Module Installation Instructions, publication 1794-IN019.	Information on how to install the FLEX I/O 8 Output Relay Modules Catalog No.1794-OW8, 1794-OW8K, 1794-OW8XT
FLEX I/O Analog Input and Output Module Installation Instructions, publication 1794-IN100.	Information on how to install the FLEX I/O Analog Input and Output Modules Catalog No.1794-IE8, 1794-IE4XOE2, 1794-OE4, 1794-IE8K, 1794-OE4K
FLEX I/O Isolated Analog Output Module Installation Instructions, publication 1794-IN037.	Information on how to install the FLEX I/O Isolated Analog 4 Input Module Catalog No.1794-OF4I
FLEX XT I/O Isolated Input Analog Module Installation Instructions, publication 1794-IN129.	Information on how to install the FLEX I/O Isolated Analog Modules Catalog No.1794-IF4IXT, 1794-OF4IXT, 1794-IF2XOF2IXT
FLEX I/O Isolated Analog Modules User Manual, publication 1794-6.5.8.	Information on how to use the FLEX I/O Isolated Analog Modules Catalog No.1794-IF4I, -OF4I, IF2XOF2I, -IF4IXT, -IF4ICFXT, -OF4IXT, IF2XOF2IXT
FLEX I/O 8 Thermocouple Input Module Installation Instructions, publication 1794-IN021.	Information on how to install the FLEX I/O Isolated Analog Modules Catalog No. 1794-IT8,1794-IR8
FLEX I/O Thermocouple/Millivolt Input Module Installation Instructions, publication 1794-IN050.	Information on how to install the Thermocouple/Millivolt Input Modules Catalog No. 1794-IRT8, 1794-IRT8K, 1794-IRT8XT
FLEX I/O Thermocouple/Millivolt Input Module User Manual, publication 1794-6.5.7.	Information on how to use the Thermocouple and Millivolt Input Module Catalog No. 1794-IT8.

Resource	Description
FLEX I/O AC Input Modules Installation Instructions, publication 1794-IN102.	Information on how to install the FLEX I/O AC Input Modules Catalog No. 1794-IA8, 1794-IA8I, 1794-IA16.
FLEX I/O Digital AC Output Modules Installation Instructions, publication 1794-IN103.	Information on how to install the FLEX I/O Digital AC Output Modules Catalog No. 1794-OA8, 1794-OA8K, 1794-OA8I, 1794-OA16.
FLEX I/O DC Power Supply Installation Instructions, publication 1794-IN069.	Information on how to install the FLEX I/O DC Power Supply Catalog No. 1794-PS13, 1794-PS3
Interconnect Cable Installation Instructions, publication 1794-5.12.	Information on how to install the extension cables. Catalog No. 1794--CE1, 1794-CE3
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.	In-depth information on grounding and wiring Allen-Bradley programmable controllers.
Allen-Bradley Industrial Automation Glossary, publication AG-7.1.	A glossary of industrial automation terms and abbreviations.

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

Notes:

Overview of the FLEX I/O PROFIBUS APBDPV1 Module

Overview

Read this chapter to familiarize yourself with the adapter module.

For Information About	See Page
The FLEX I/O System	1
Purpose of the FLEX I/O PROFIBUS APBDPV1 Adapter	2
Differences Between APB and APBDPV1 Adapters	2
PROFIBUS APBDPV1 Adapter Components	3
Mount and Remove Your System	4
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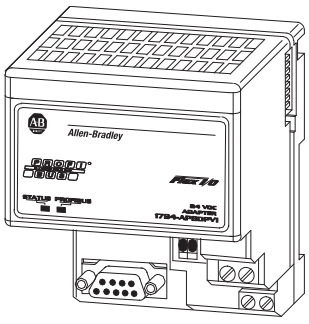
The FLEX I/O System

The FLEX I/O system is a small, modular I/O system for distributed applications that performs all of the functions of rack-based I/O. The FLEX I/O system contains the following components:

Adapter



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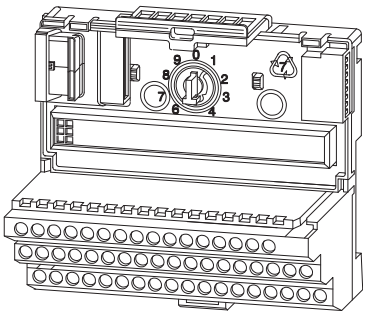
Terminal base



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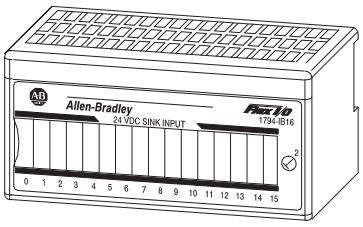
I/O module



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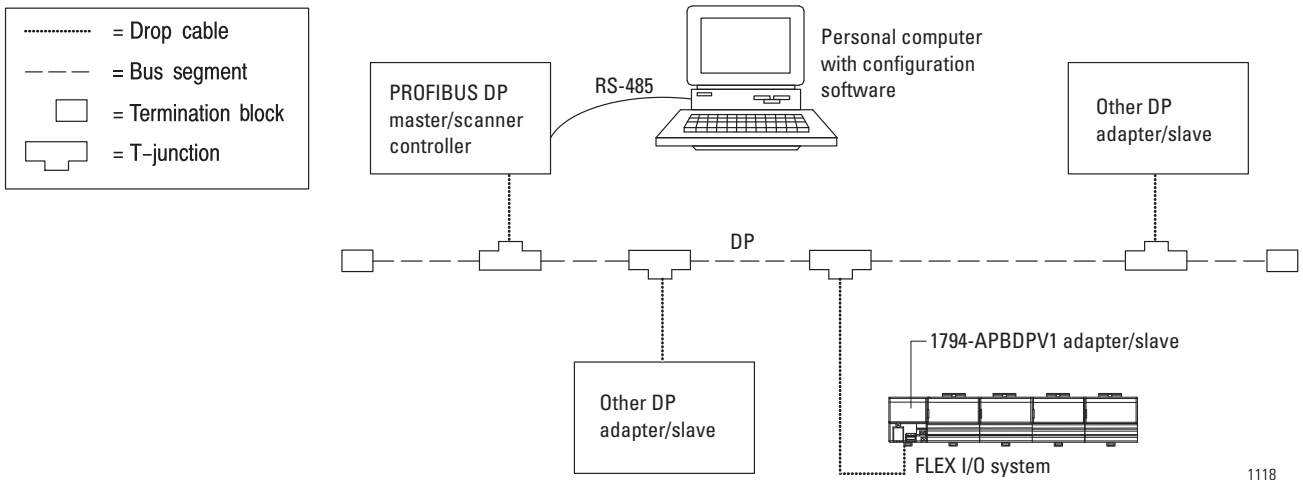
- PROFIBUS adapter/power supply – powers the internal logic for as many as eight I/O modules
- terminal base – contains a terminal strip to terminate wiring for two- or three-wire devices
- I/O module – contains the bus interface and circuitry needed to perform specific functions related to your application

Purpose of the FLEX I/O PROFIBUS APBDPV1 Adapter

The 1794-APBDPV1 module is a FLEX I/O communications adapter that interacts with the FLEX I/O backplane and any PROFIBUS DP master/scanner controller on a PROFIBUS DP network.

The 1794-APBDPV1 module is a slave device to the DP master/scanner, and is a master controller of the FLEX I/O system where it is installed. The I/O data exchange occurs as follows: Output data is sent from the DP master/scanner controller across the PROFIBUS DP network to the 1794-APBDPV1 adapter. The adapter then automatically transfers the data across the FLEX I/O backplane to the output modules. Inputs from the input modules are collected by the FLEX I/O adapter via the backplane and sent across the PROFIBUS DP network to the DP master/scanner controller.



Differences Between APB and APBDPV1 Adapters

This section describes the differences between the 1794-APB FLEX I/O PROFIBUS and the 1794-APBDPV1 FLEX I/O PROFIBUS APBDPV1 adapter modules.

DP-V1 Protocol

The FLEX I/O PROFIBUS APBDPV1 adapter uses a newer version of PROFIBUS DP (DP1) protocol whereas the The FLEX I/O PROFIBUS APB adapter uses the first generation PROFIBUS DP protocol (DP-0).

Functionality

The FLEX I/O PROFIBUS APBDPV1 adapter features Identification & Maintenance (I&M) functions. These functions specify how certain device describing data must be unambiguously stored in PROFIBUS devices essentially enabling easy access to current information on the device. The adapter also supports newer HART modules than the The FLEX I/O PROFIBUS APB adapter.

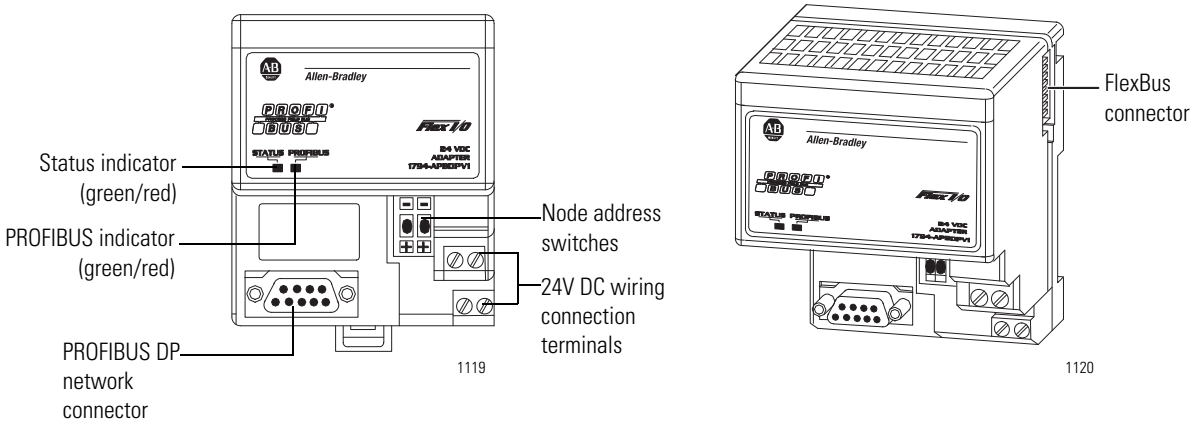
Bandwidth and Range

The FLEX I/O PROFIBUS APB adapter baud-rate is now 12 MBd and, although the physically PROFIBUS address range is still limited to 1..99, the logical address range is 1..126.

PROFIBUS APBDPV1 Adapter Components

The adapter module consists of the following components:

- two diagnostic indicators
- PROFIBUS DP network connector
- 24V DC power wiring connection terminals
- two node address switches



Diagnostic Indicators

Diagnostic indicators are located on the front panel of the adapter module. They show both normal operation and error conditions in your FLEX I/O system. The indicators are:

- Device status (STATUS)
- Communication link status (PROFIBUS)

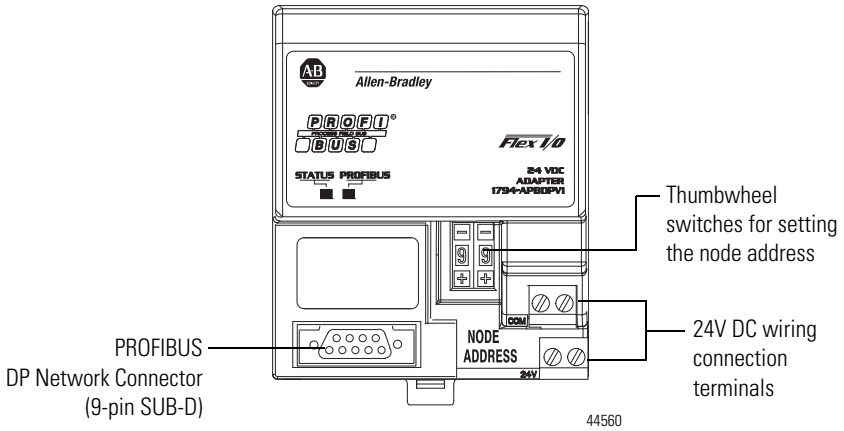
Upon power-up, the adapter goes to an initialization state and performs a self-test (memory check, data memory clear, CRC on code). The indicators also go through a self-test sequence. If a failure occurs, the adapter transitions to a faulted state and waits for reset (cycle power). Otherwise, the adapter begins monitoring the network (run state) for messages.

Network Connector

Use the 9-pin SUB-D connector to connect your adapter to the PROFIBUS network.

Set the Node Address Switches

Set the thumbwheel switches to 00 to allow node addressing by software configuration tool to set the range from 1...125. Address changes take effect only after cycling power. Use a pen to press either the + or – buttons to change the number.



Power Wiring

Connection terminals are provided for connecting the required 24V DC power to the front of the module. The power wiring can be daisy-chained to the terminal base unit located next to the adapter to supply power to the module installed in that base unit.

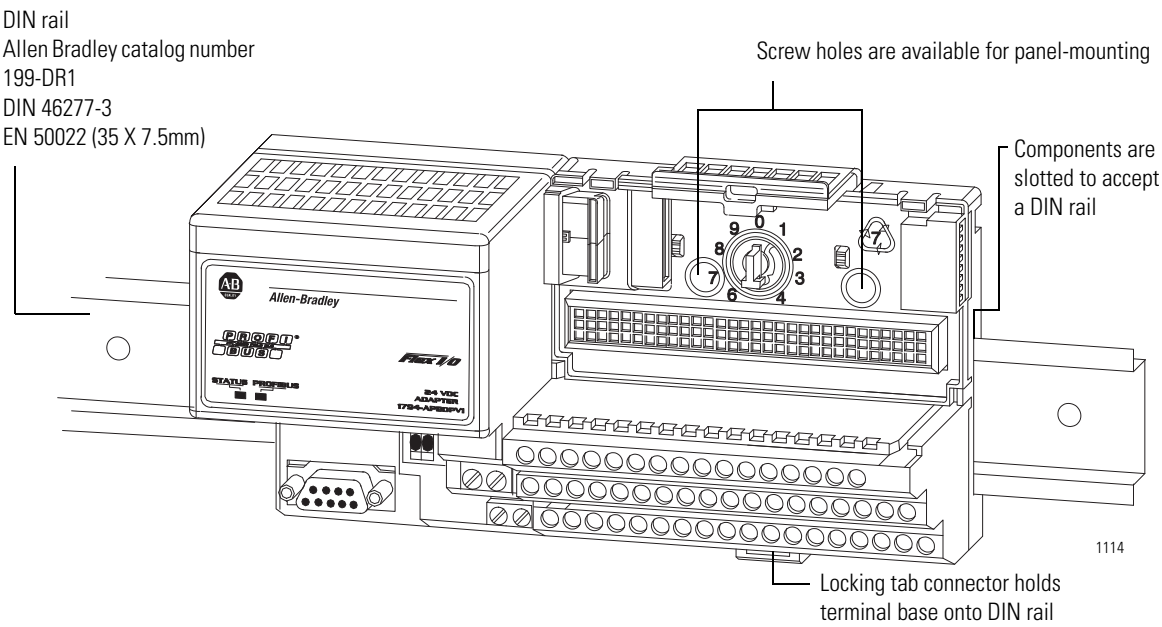
Refer to the FLEX I/O PROFIBUS Communications Adapter Installation Instructions, publication 1794-IN114, that you received with your adapter to learn how to install and wire the adapter.

Mount and Remove Your System

You can horizontally or vertically mount the FLEX I/O system on a standard DIN rail. The adapter and terminal base easily snap on the DIN rail by hand. Refer to the installation instructions shipped with these components.

Screw holes are also provided to horizontally or vertically panel-mount your system in an enclosure. To panel-mount your FLEX I/O system, use the optional mounting kit (1794-NM1). See Example of a DIN Rail-Mounted System on page 5.

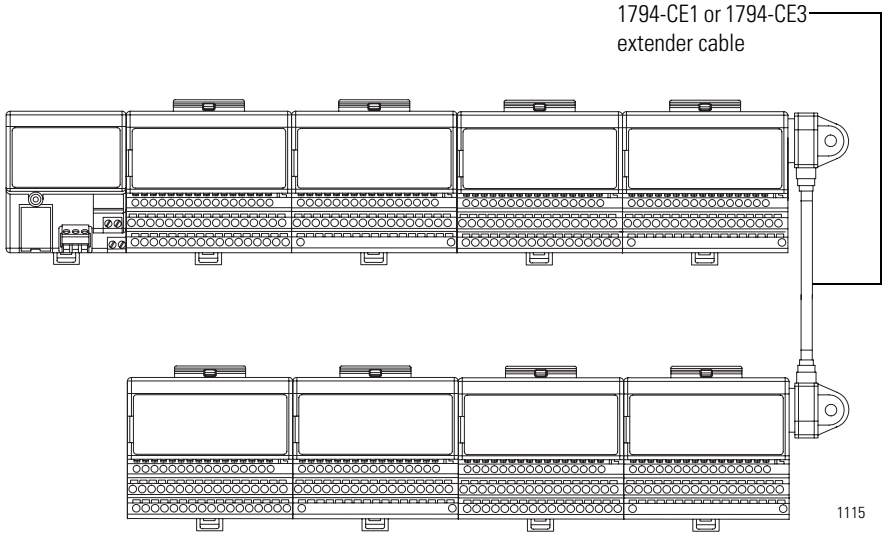
Example of a DIN Rail-Mounted System



Optional Accessories

Extender Cables (1794-CE1 or -CE3)

Use the optional 1794-CE1, 0.3m (11.81 in.) or -CE3, 0.9m (35.43 in.) extender cable (one per system) to arrange your system in two rows or split your system into horizontal and vertical orientation.

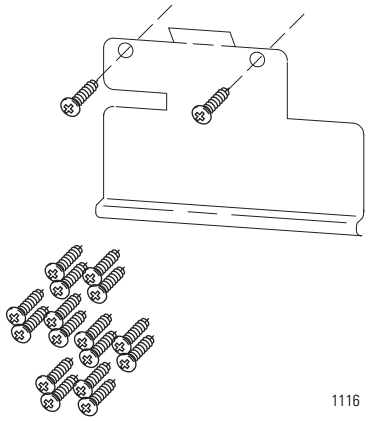


ATTENTION: Do not use more than one extender cable per system

Mounting Kit (1794-NM1)

Use the optional 1794-NM1 mounting kit to mount your system on a panel or wall without a DIN rail.

1794-NM1
Mounting Kit with
18 screws (2 screws for
the adapter and 2 screws
for each module



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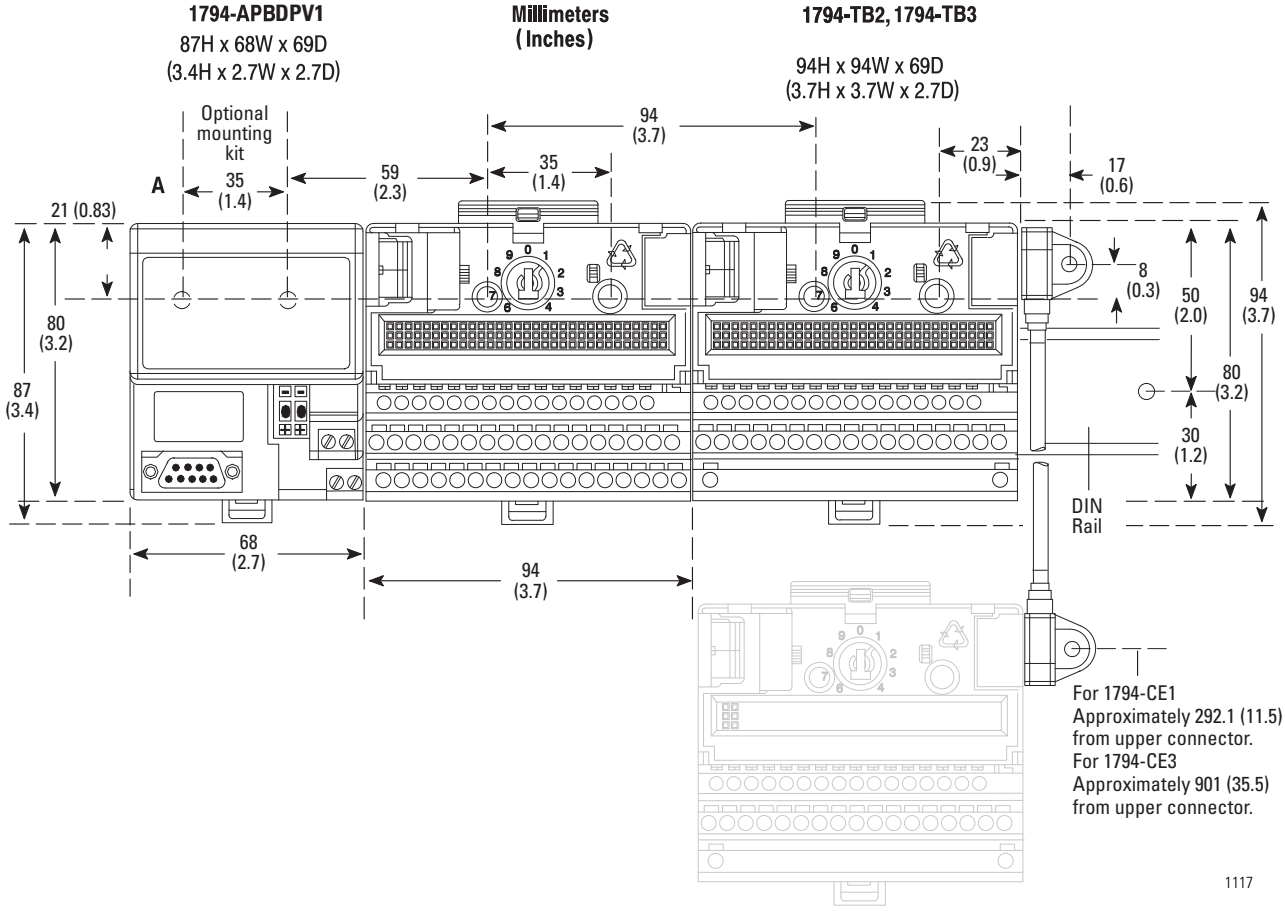
Mounting Dimensions and Spacing Requirements



Chapter Summary

In this chapter you learned about the FLEX I/O PROFIBUS APBDPV1 adapter module and the FLEX I/O system. Read the next chapter to learn how to communicate with your module.

Notes:

Communicate With Your Module

Overview

Read this chapter to familiarize yourself with configurable features on the input and output analog modules

For Information About	See Page
Communication Over the I/O Backplane	9
Polled I/O Structure	10
Map Data into the Image Table	12
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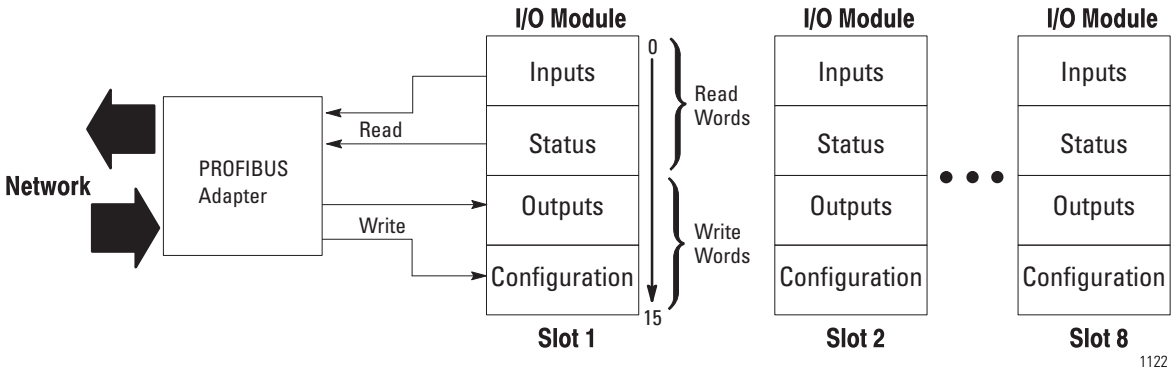
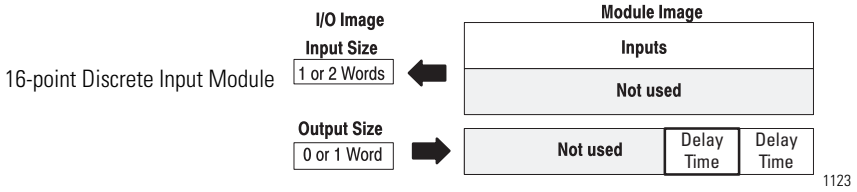
Communication Over the I/O Backplane

One 1794-APBDPV1 PROFIBUS adapter can interface with up to eight terminal base units with installed FLEX I/O modules, forming a FLEX I/O system of up to eight slots. The adapter communicates to other network system components over the PROFIBUS network. The adapter communicates with its I/O modules over the backplane.



The I/O map for a module is divided into read words and write words. Read words consist of input and status words, and write words consist of output and configuration words. The number of read words or write words can be 0 or more. The length of each I/O module's read words and write words vary in size depending on module complexity. Each I/O module will support at least 1 input word or 1 output word. Status and configuration are optional, depending on the module.

For example, a 16 point discrete input module will have up to 2 read words and 1 write word.

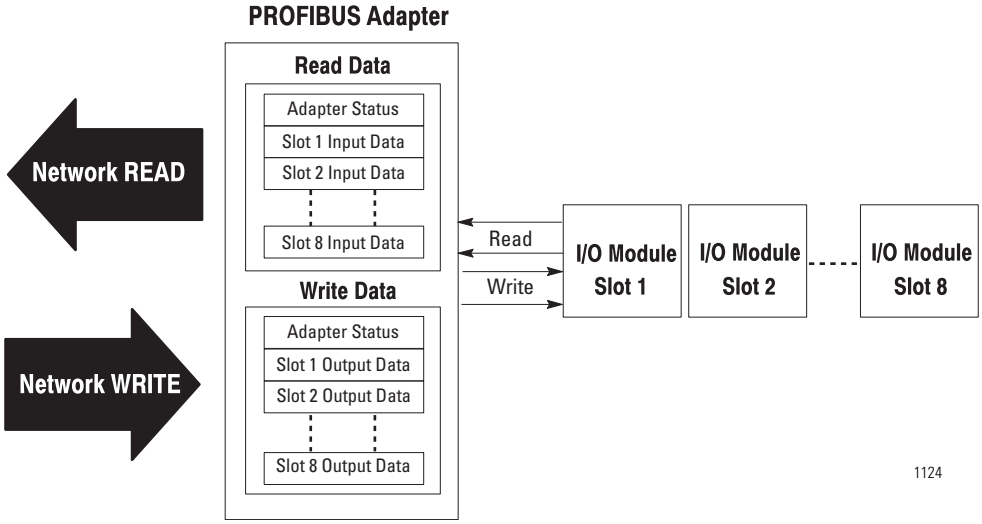


Refer to each module user manual I/O map for the exact mapping.

Polled I/O Structure

The first word of output data received by the adapter is the Adapter Status Word. Output data is received by the adapter in the order of the installed I/O modules. The Output data for Slot 1 is received first, followed by the Output data for Slot 2, and so on up to slot 8. All bits in the output status word are reserved.

The first word of input data sent by the adapter is the Adapter Status Word. This is followed by the input data from each slot, in the order of the installed I/O modules. The Input data from Slot 1 is first after the status word, followed by Input data from Slot 2, and so on up to slot 8.

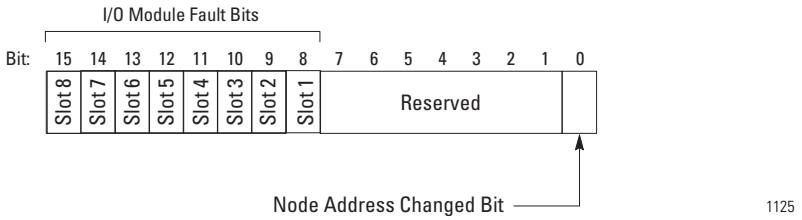


Adapter Input Status Word

The input status word consists of:

- I/O module fault bits — 1 status bit for each slot

- node address changed — 1 bit



The adapter input status word bit descriptions are shown in Table Input Status Word Bits.

Input Status Word Bits

Bit Description	Bit	Explanation
I/O Module Fault	8	This bit is set (1) when an error is detected in slot position 1.
	9	This bit is set (1) when an error is detected in slot position 2.
	10	This bit is set (1) when an error is detected in slot position 3.
	11	This bit is set (1) when an error is detected in slot position 4.
	12	This bit is set (1) when an error is detected in slot position 5.
	13	This bit is set (1) when an error is detected in slot position 6.
	14	This bit is set (1) when an error is detected in slot position 7.
	15	This bit is set (1) when an error is detected in slot position 8.
Reserved	1…7	Reserved
Node Address changed	0	This bit is set (1) when the node address switch setting has been changed since power up.

Possible causes for an **I/O module fault** are:

- transmission errors on the FLEX I/O backplane
- a failed module
- a module removed from its terminal base
- an incorrect module inserted in a slot position
- an empty slot

The node address changed bit is set when the node address switch setting has been changed since power up. The new node address does not take effect until the adapter has been powered down and then powered back up. Until this power cycling occurs, the node address switches will not match the actual node address.

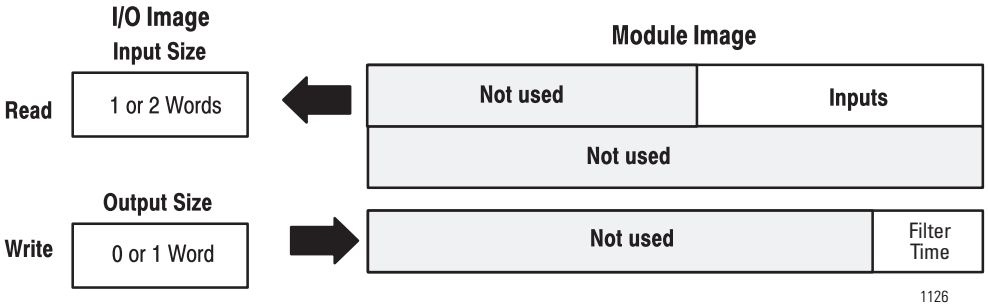
Map Data into the Image Table

Commonly used FLEX I/O modules used with the PROFIBUS adapter are listed below. A full list of modules is available in the GSD file. For more information on the GSD file, see Device Data Base (GSD) File in Appendix B.

FLEX I/O Data Mapping Tables

Module Description	Catalog Number	For image table mapping see page
8 Sink input module	1794-IB8	12
16 Sink input module	1794-IB16	13
8 Source output module	1794-OB8	14
16 Source output module	1794-OB16	14
16 Source input module	1794-IV16	15
16 Sink output module	1794-OV16	16
8 Electronically fused output module	1794-OB8EP	16
10 input/6 output module	1794-IB10XOB6	17
8 input module	1794-IA8	18
8 output module	1794-OA8	19
8 relay output module	1794-OW8	19
8 input analog module	1794-IE8	20
4 output analog module	1794-OE4	23
4 in/2 out analog combo module	1794-IE4XOE2	25
8 input RTD analog module	1794-IR8	28
8 input thermocouple module	1794-IT8	32
8 input thermocouple/RTD/mV module	1794-IRT8	36
2 input pulse counter module	1794-ID2	59
4 input encoder counter module	1794-IP4	63
SCANport module	1203-FM1	66

1794-IB8 — 8 Point Digital Input Module Image Table Mapping



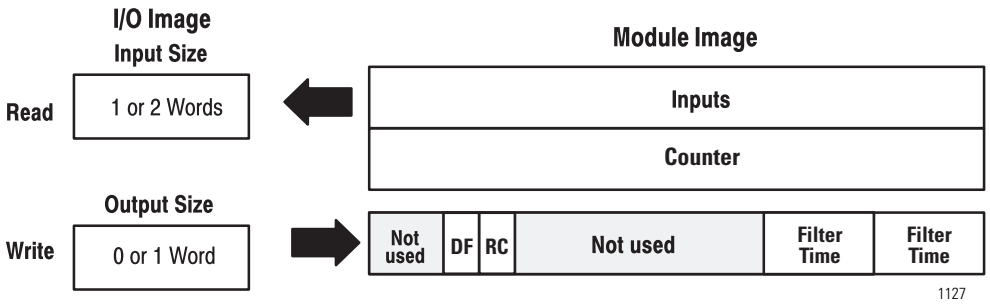
1794-IB8 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read Words**
	Not used								D7	D6	D5	D4	D3	D2	D1	D0	Read Word 0
	Not used																Read Word 1
	Not used													FT 00…07			Write Word 0
Where:	D = Input Data (D0 corresponds to input 0, D1 corresponds to input 1, and so on) DT = Input Filter Time (FT 00…07 corresponds to inputs 0…7)																

1794-IB8 Input Filter Times

			Description	Selected Filter Time
02	**01**	**00**	**Filter Time for Inputs 00…07**	
0	0	0	Filter Time 0 (default)	0.256 ms
0	0	1	Filter Time 1	0.512 ms
0	1	0	Filter Time 2	1 ms
0	1	1	Filter Time 3	2 ms
1	0	0	Filter Time 4	4 ms
1	0	1	Filter Time 5	8 ms
1	1	0	Filter Time 6	16 ms
1	1	1	Filter Time 7	32 ms

1794-IB16 – 16-point Digital Input Module Image Table Mapping



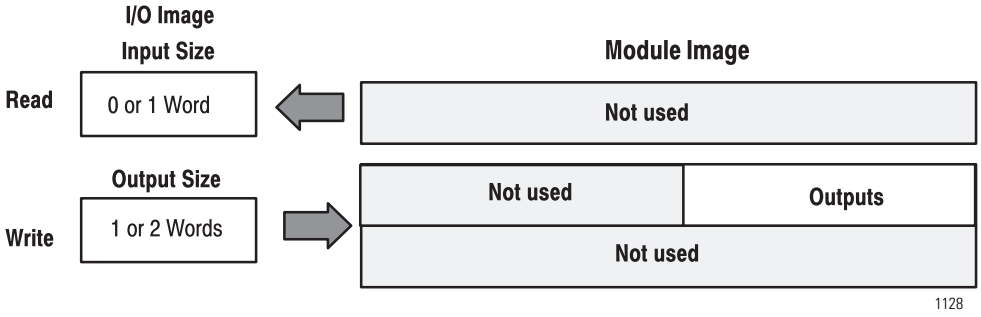
1794-IB16 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read Words**
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Read Word 0
	Counter																Read Word 1
	Not used				DF	RC					FT 12…15			FT 00…07			Write Word 0
Where:	D = Input Data (D0 corresponds to input 0, D1 corresponds to input 1, and so on) DT = Input Filter Time (FT 00…11 corresponds to inputs 0…11; FT 12…15 corresponds to inputs 12…15) DF = Disable Filter RC = Reset Counter																

1794-IB16 Input Delay Times

			Description	Selected Filter Time
02	01	00	Filter Time for Inputs 00…11	
05	04	03	Filter Time for Inputs 12…15	
0	0	0	Filter Time 0 (default)	0.256 ms
0	0	1	Filter Time 1	0.512 ms
0	1	0	Filter Time 2	1 ms
0	1	1	Filter Time 3	2 ms
1	0	0	Filter Time 4	4 ms
1	0	1	Filter Time 5	8 ms
1	1	0	Filter Time 6	16 ms
1	1	1	Filter Time 7	32 ms

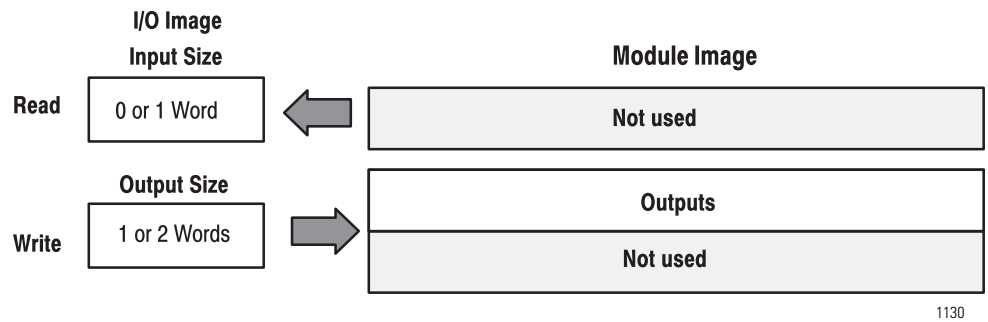
1794-OB8 – 8 Point Discrete Output Module Image Table Mapping



1794-OB8 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	Read Words
	Not used																Read Word 0
	Not used								O7	O6	O5	O4	O3	O2	O1	O0	Write Word 0
	Not used																Write Word 1
Where:	O = Output value (O0 corresponds to output 0, O1 corresponds to output 1, and so on)																

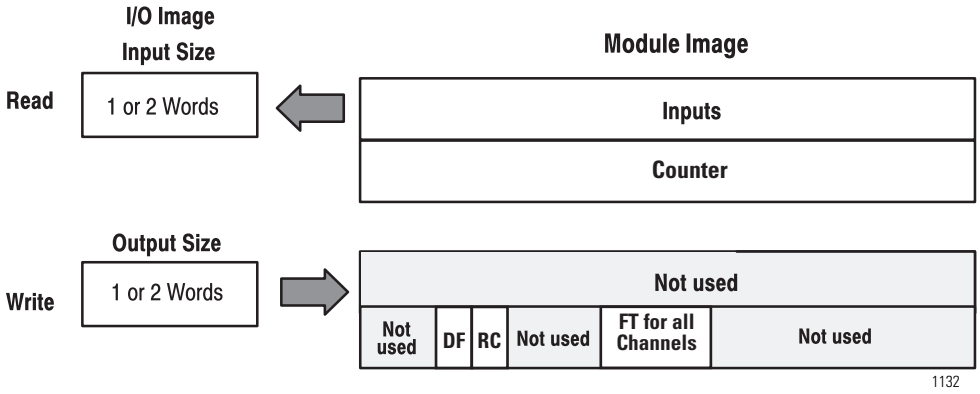
1794-OB16 – 16-point Discrete Output Module Image Table Mapping



1794-OB16 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Not used																Read Word 0
	O15	O14	O13	O12	O11	O10	O9	O8	O7	O6	O5	O4	O3	O2	O1	O0	Write Word 0
	Not used																Write Word 1
Where:	O = Output value (O0 corresponds to output 0, O1 corresponds to output 1, and so on)																

1794-IV16 – 16-point Source Input Module Image Table Mapping



1794-IV16 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Read Word 0
	Counter																Read Word 1
	Not used		DF	RC	NU	FT for all channels			Not used								Write Word 0
Where:	D = Input Data (D0 corresponds to input 0, D1 corresponds to input 1, and so on) DT = Input Filter Time (FT 00…11 corresponds to inputs 0…11; FT 12…15 corresponds to inputs 12…15) DF = Disable Filter RC = Reset Counter NU = Not Used																

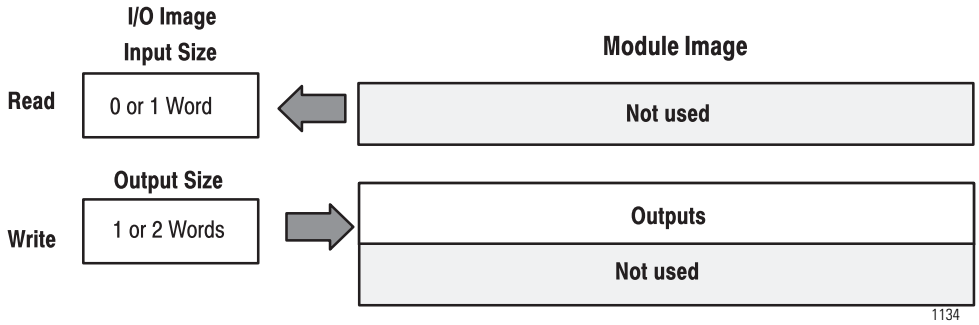
1794-IV16 Input Filter Times

			Description	Selected Filter Time
10	**09**	**08**	**Filter Time for Inputs 00-15 (00…17)**	
0	0	0	Filter Time 0 (default)	216 µs
0	0	1	Filter Time 1	512 µs
0	1	0	Filter Time 2	1 ms
0	1	1	Filter Time 3	2 ms
1	0	0	Filter Time 4	4 ms

1794-IV16 Input Filter Times

			Description	Selected Filter Time
10	09	08	Filter Time for Inputs 00-15 (00…17)	
1	0	1	Filter Time 5	8 ms
1	1	0	Filter Time 6	16 ms
1	1	1	Filter Time 7	32 ms

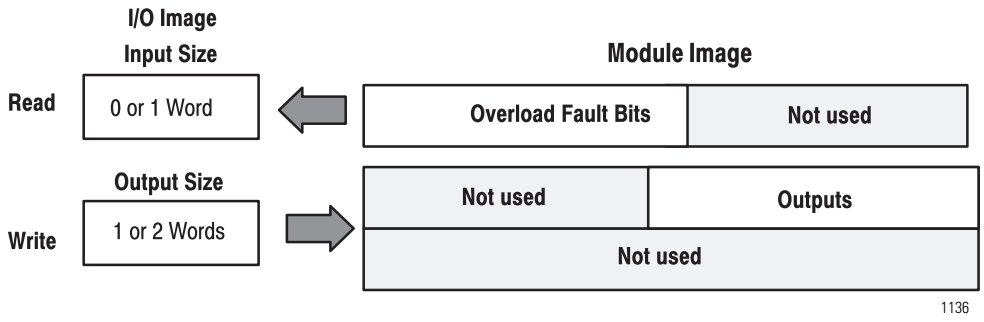
1794-OV16 – 16-point Sink Output Module Image Table Mapping



1794-OV16 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	Read/Write Words
	Not used																Read Word 0
	O15	O14	O13	O12	O11	O10	O9	O8	O7	O6	O5	O4	O3	O2	O1	O0	Write Word 0
	Not used																Write Word 1
Where:	O = Output value																

1794-OB8EP – 8-point Discrete Protected Output Module Image Table Mapping



1794-OB8EP Memory Map

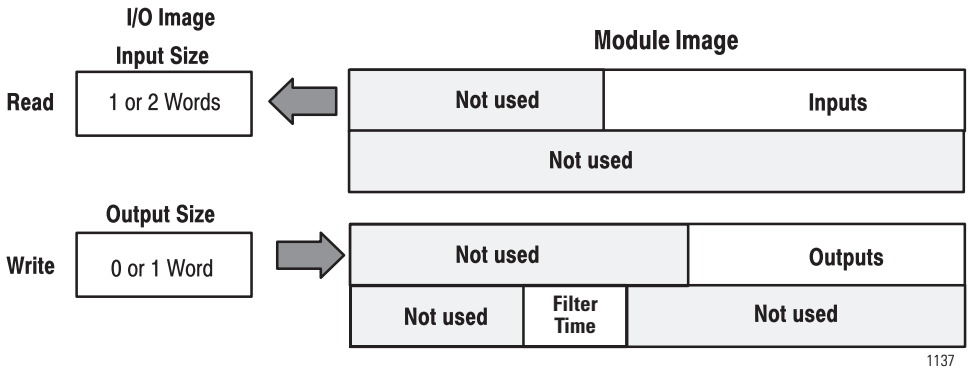
Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	F7	F6	F5	F4	F3	F2	F1	F0	Reserved[1]								Read Word 0
	Not used							FR	O7	O6	O5	O4	O3	O2	O1	O0	Write Word 0
	Reserved																Write Word 1

Where: F = overload fault bits – 1 = fault present; 0 = no fault
Ox = Output Data (O0 corresponds to output 0, O1 corresponds to output 1, and so on)
FR = fault reset bit – 1 = reset output; 0 = no change.

Using the Fault Reset Button When you press the manual reset button:
1. The fault indicator for the faulted output turns off for about 1.2 s (the faulted output will not attempt to turn on during this delay)
2. After the 1.2 s delay, the faulted output attempts to turn on
3. If the external condition causing the fault is corrected, the output remains on, the fault indicator is off, and the status indicator is on

(1) The unused lower byte in read word 1 floats during operation. Do not use this byte for fault status.

1794-IB10XOB6 – 16-point Digital Input/Output Module Image Table Mapping



1794-IB10XOB6 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Not used						I9	I8	I7	I6	I5	I4	I3	I2	I1	I0	Read Word 0
	Not used																Read Word 1
	Not used										O5	O4	O3	O2	O1	O0	Write Word 0
	Not used					Filter Time			Not used								Write Word 1

Where: I = Input Channel
O = Output Channel

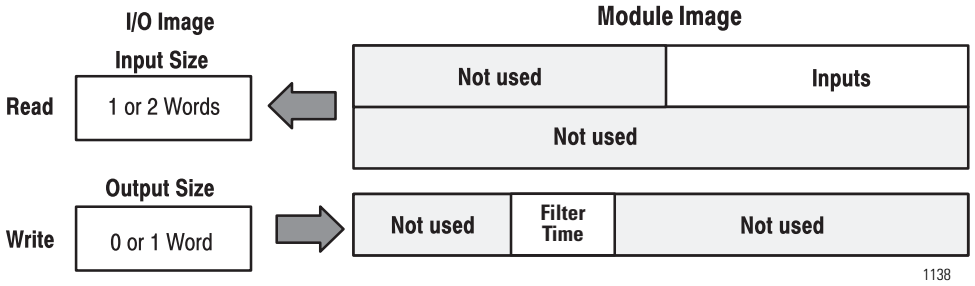
1794-IB10XOB6 Input Filter Times

			Description	Selected Filter Time
02	**01**	**00**	**Filter Time for Inputs 00…07**	
0	0	0	Filter Time 0 (default)	0.256 ms
0	0	1	Filter Time 1	0.512 ms
0	1	0	Filter Time 2	1 ms

1794-IB10XOB6 Input Filter Times

			Description	Selected Filter Time
02	01	00	Filter Time for Inputs 00…07	
0	1	1	Filter Time 3	2 ms
1	0	0	Filter Time 4	4 ms
1	0	1	Filter Time 5	8 ms
1	1	0	Filter Time 6	16 ms
1	1	1	Filter Time 7	32 ms

1794-IA8 – 8-point Discrete Input Module Image Table Mapping



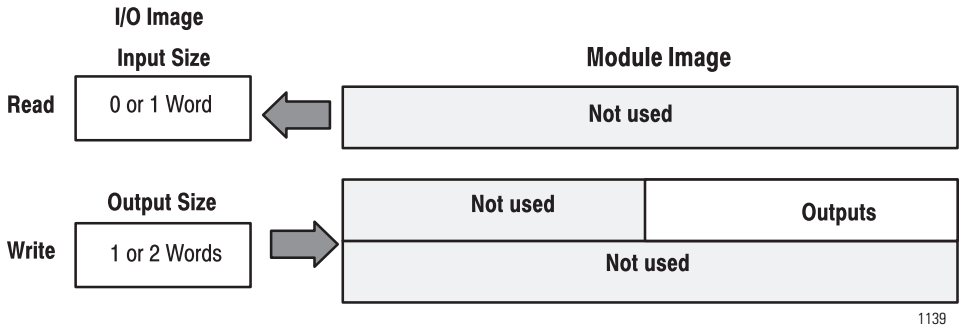
1794-IA8 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	Read/Write Words
	Not used								D7	D6	D5	D4	D3	D2	D1	D0	Read Word 0
	Not used																Read Word 1
	Not used					FT 00…07			Not used								Write Word 0
Where:	D = Input Data (D0 corresponds to input 0, D1 corresponds to input 1,and so on) FT = Input Filter Time (FT 00…07 corresponds to inputs 0…7)																

1794-IA8 Input Filter Times

Bits			Description	Maximum Filter Time	
02	01	00	Filter Time for Inputs 00…15 (00…17)	Off to On	On to Off
0	0	0	Filter Time 0 (default)	8.6 ms	26.6 ms
0	0	1	Filter Time 1	9 ms	27 ms
0	1	0	Filter Time 2	10 ms	28 ms
0	1	1	Filter Time 3	12 ms	30 ms
1	0	0	Filter Time 4	17 ms	35 ms
1	0	1	Filter Time 5	26 ms	44 ms
1	1	0	Filter Time 6	43 ms	61 ms
1	1	1	Filter Time 7	78 ms	96 ms

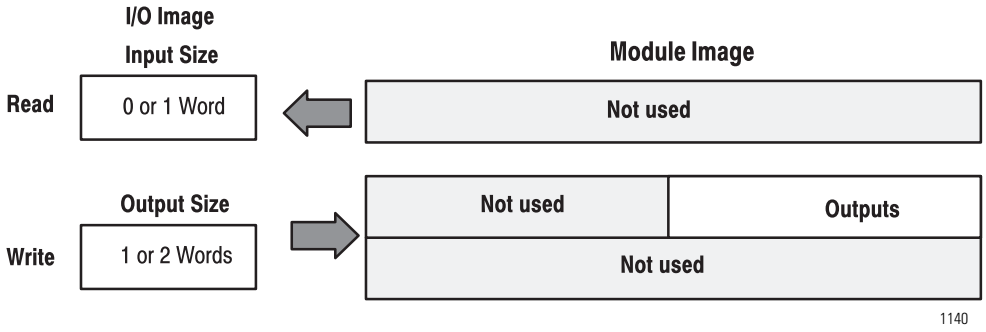
1794-OA8 – 8-point Discrete Output Module Image Table Mapping



1794-OA8 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read Words**
	Not used																Read Word 0
	Not used								O7	O6	O5	O4	O3	O2	O1	O0	Write Word 0
	Not used																Write Word 1
Where:	O = Output value (O0 corresponds to output 0, O1 corresponds to output 1, and so on)																

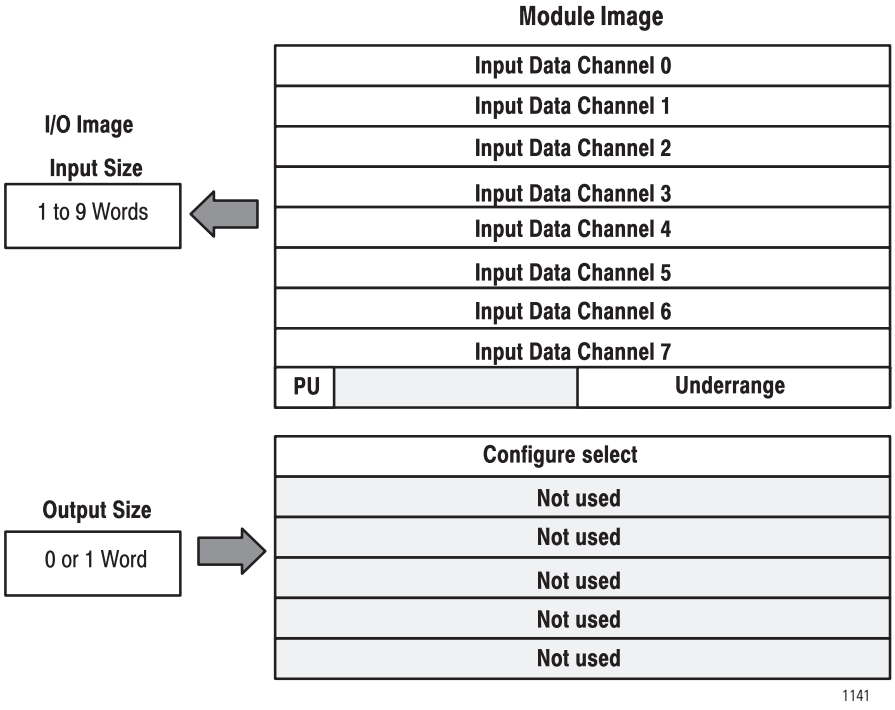
1794-OW8 – 8-point Discrete Relay Output Module Image Table Mapping



1794-OW8 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Not used																Read Word 0
	Not used								O7	O6	O5	O4	O3	O2	O1	O0	Write Word 0
	Not used																Write Word 1
Where:	O = Output value (O0 corresponds to output 0, O1 corresponds to output 1, and so on)																

1794-IE8 Series B – 8 Input Analog Module Image Table Mapping



1794-IE8/B Memory Map

Decimal Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Size**
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Value Channel 0															Read Word 0
	S	Analog Value Channel 1															Read Word 1
	S	Analog Value Channel 2															Read Word 2
	S	Analog Value Channel 3															Read Word 3
	S	Analog Value Channel 4															Read Word 4
	S	Analog Value Channel 5															Read Word 5
	S	Analog Value Channel 6															Read Word 6
	S	Analog Value Channel 7															Read Word 7
	PU	Not used – set to zero							U7	U6	U5	U4	U3	U2	U1	U0	Read Word 8
	C7	C6	C5	C4	C3	C2	C1	C0	F7	F6	F5	F4	F3	F2	F1	F0	Write Word 0
	Not used																Write Word 1…5

Where:
PU = Power up bit – included in series B modules only.
U = Underrange bits for 4…20 mA inputs
C = Configure select bit
F = Full range bit
S = sign bit (in 2's complement)

1794-IE8/B Range Selection Bits

Channel No.	Channel 0		Channel 1		Channel 2		Channel 3		Channel 4		Channel 5		Channel 6		Channel 7	
	F0	C0	F1	C1	F2	C2	F3	C3	F4	C4	F5	C5	F6	C6	F7	C7
Decimal Bits (Octal Bits)	**00**	**08 (10)**	**01**	**09 (11)**	**02**	**10 (12)**	**03**	**11 (13)**	**04**	**12 (14)**	**04**	**13 (15)**	**06**	**14 (16)**	**07**	**15 (17)**
0…10V DC/0…20 mA	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
4…20 mA	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
-10…10V DC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Where:
C = Configure select bit
F = Full range bit
Off = When configured to off, individual channels will return 0000H on Series B modules, and 4…20 mA on Series A modules.

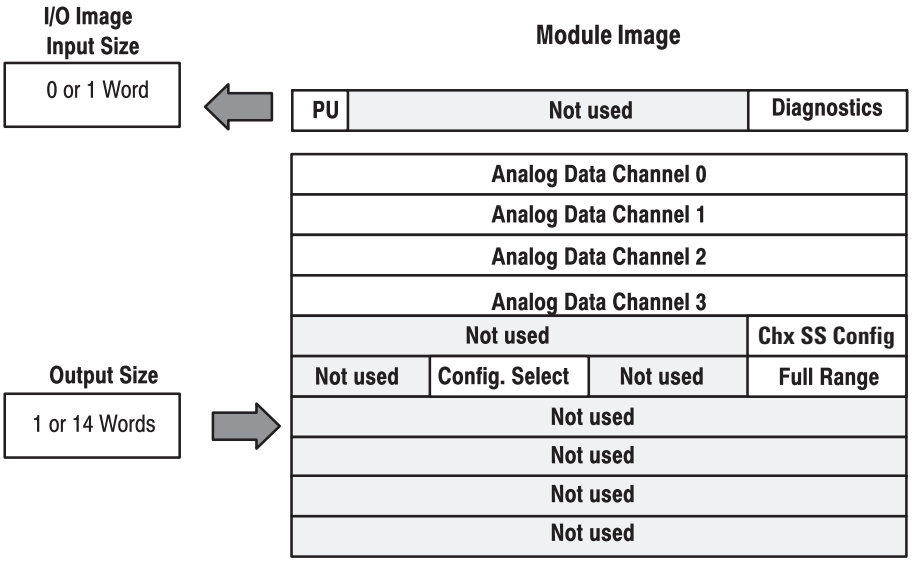
1794-IE8 Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 0	Bits 00…14	**Channel 0 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 0 analog data sign bit.
Read Word 1	Bits 00…14	**Channel 1 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 1 analog data sign bit.
Read Word 2	Bits 00…14	**Channel 2 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 2 analog data sign bit.
Read Word 3	Bits 00…14	**Channel 3 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 3 analog data sign bit.
Read Word 4	Bits 00…14	**Channel 4 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 4 analog data sign bit.
Read Word 5	Bits 00…14	**Channel 5 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 5 analog data sign bit.
Read Word 6	Bits 00…14	**Channel 6 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 6 analog data sign bit.
Read Word 7	Bits 00…14	**Channel 7 analog data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15	Channel 7 analog data sign bit.

1794-IE8 Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 8	Bits 00…07	Underrange bits (U) for individual channels (4...20 mA current input only) – Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. When set (1), indicates either a broken or open input wire, or input current below 4.20 mA.
	Bits 08…14	Not used – set to 0.
	Bit 15	Power up bit – included in Series B modules only. This bit is 0 in series A modules. This bit is set to 1 when all bits in the configuration register are 0 (unconfigured state). The configuration register can be cleared by either of the reset inputs, or by the user writing all zeroes to it.
Write Word 0	Bits 00…07	Full range bits (F) for individual channels – Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. Refer to range selection table.
	Bits 08…15	Configure select bits (C) for individual channels – Bit 08 corresponds to input channel 0, bit 09 corresponds to input channel 1, and so on. Refer to range selection table.
Write Word 1	Bits 00…15	Not used – set to 0
Write Word 2	Bits 00…15	Not used – set to 0
Write Word 3	Bits 00…15	Not used – set to 0
Write Word 4	Bits 00…15	Not used – set to 0
Write Word 5	Bits 00…15	Not used – set to 0

1794-OE4 Series B – 4 Output Analog Module Image Table Mapping



1794-OE4/B Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Not used – set to zero											W3	W2	W1	W0	Read Word 0
	S	Analog Value Channel 0															Write Word 0
	S	Analog Value Channel 1															Word 1
	S	Analog Value Channel 2															Word 2
	S	Analog Value Channel 3															Word 3
	S	Not used – set to 0											Chx Safe State Config				Word 4
	PU	Not used – set to 0			C3	C2	C1	C0	Not used – set to 0				F3	F2	F1	F0	Word 5
	S	Not used – set to 0															Word 6…9

Where:
PU = Power up bit – included in Series B modules only.
W = Diagnostic bits for current output wire broken or load resistance high. (Not used on voltage outputs.)
S = Sign bit (in 2's complement)
C = Configure select bit
F = Full range bit

1794-OE4/B Range Selection Bits (Write Word 6)

Channel No.	Channel 0		Channel 1		Channel 2		Channel 3	
	F0	C0	F1	C1	F2	C2	F3	C3
Decimal Bits (Octal Bits)	**00**	**08**	**01**	**09**	**02**	**10**	**03**	**11**
4…20 mA	1	0	1	0	1	0	1	0
0…10V DC/0…20 mA	0	1	0	1	0	1	0	1

1794-OE4/B Range Selection Bits (Write Word 6)

Channel No.	Channel 0		Channel 1		Channel 2		Channel 3	
	F0	C0	F1	C1	F2	C2	F3	C3
Decimal Bits (Octal Bits)	00	08	01	09	02	10	03	11
-10…10V DC	1	1	1	1	1	1	1	1
Off	0	0	0	0	0	0	0	0
Where:	C = Configure select bit F = Full range bit Off = When configured to off, individual channels will return 0V.							

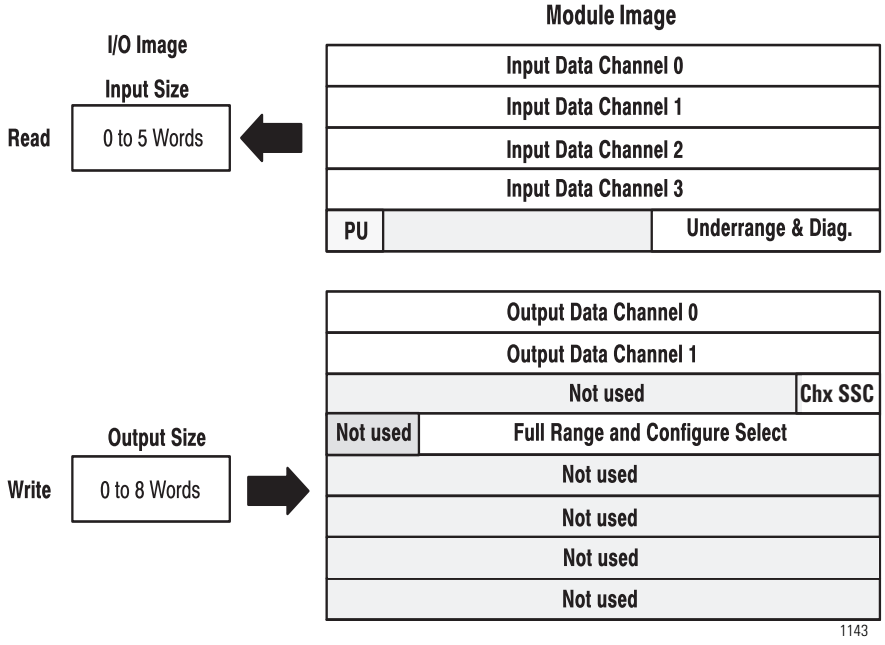
1794-OE4/B Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 0	Bits 00…03	**Current Outputs only** – When set (1), the wire on the output is broken or the load resistance is too high. Bit 00 corresponds to channel 0, bit 01 corresponds to channel 2, and so on.
	Bit 04…14 (04…16)	Not used – set to zero.
	Bits 15 (17)	**Power Up bit –** included in Series B modules only. This bit is 0 in Series A modules. This bit is set to 1 when all bits in the configuration register are 0 (unconfigured state). The configuration register can be cleared by either of the reset inputs, or by the user writing all zeroes to it.
Write Word 0	Bit 00…14 (00…16)	**Channel 0 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 0 analog data sign bit.
Write Word 1	Bit 00…14 (00…16)	**Channel 1 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 1 analog data sign bit.
Write Word 2	Bit 00…14 (00…16)	**Channel 2 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 2 analog data sign bit.
Write Word 3	Bit 00…14 (00…16)	**Channel 3 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 3 analog data sign bit.
Write Word 4	Bit 00…03	**Chx Safe State Config –** for individual channels. These bits control the safe state analog outputs. Bit 00 corresponds to output channel 0, bit 01 corresponds to output channel 1, and so on. 1 = use words 0, 1, 2 or 3 as directed by channel number n 0 = use words 10, 11, 12 or 13 as directed by channel n When bits 00…03 are all cleared (0) simultaneously by a communication error or user choice thru the programmable controller program, word 5 full range and configure select bits are preserved at their last setting.
	Bits 04…15 (04…17)	Not used – set to zero.

1794-OE4/B Word/Bit Descriptions

Word	Decimal Bit	Definition
Write Word 5	Bits 00…03	**Full range bits (F)** for individual channels – Bit 00 corresponds to output channel 0, bit 01 corresponds to output channel 1, and so on.
	Bits 04…07	Not used – set to zero.
	Bits 08…11 (10…13)	**Configure select bits (C)** for individual channels
	Bits 12…15 (14…17)	Not used – set to zero.
Write Words 6...9	Bits 00…15 (00…17)	Not used – set to zero.

1794-IE4XOE2 Series B – Analog Combo Module Image Table Mapping



1794-IE4XOE2 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	S	Analog Value Channel 0															Read Word 0
	S	Analog Value Channel 1															Read Word 1
	S	Analog Value Channel 2															Read Word 2
	S	Analog Value Channel 3															Read Word 3
	PU	Not used – set to 0									W1	W0	U3	U2	U1	U0	Read Word 4
	S	Analog Data – Output Channel 0															Write Word 0
	S	Analog Data – Output Channel 1															Write Word 4
	Not used – set to 0														Chx SSC		Write Word 2
	Not used		C5	C4	C3	C2	C1	C0	0	0	F5	F4	F3	F2	F1	F0	Write Word 3

1794-IE4XOE2 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Not used – set to 0																
	Not used – set to zero.																Write Words 8 and 9

Where: PU = Power up bit – included in Series B modules only.
W = Diagnostic bits for current output wire broken or load resistance high. (Not used on voltage outputs.)
U = Underrange bits for 4…20 mA inputs
S = Sign bit (in 2's complement)
Chx SSC = Chx Safe State Config
C = Configure select bit
F = Full range bit

1794-IE4XOE2 Range Selection Bits

Channel No.	Input Channel 0		Input Channel 1		Input Channel 2		Input Channel 3		Output Channel 0		Output Channel 1	
	F0	**C0**	**F1**	**C1**	**F2**	**C2**	**F3**	**C3**	**F4**	**C4**	**F5**	**C5**
Decimal Bits (Octal Bits)	**00**	**08 (10)**	**01**	**09 (11)**	**02**	**10 (12)**	**03**	**11 (13)**	**04**	**12 (14)**	**05**	**13 (15)**
4…20 mA	1	0	1	0	1	0	1	0	1	0	1	0
0…10V DC/0…20 mA	0	1	0	1	0	1	0	1	0	1	0	1
-10…10V DC	1	1	1	1	1	1	1	1	1	1	1	1
Off	0	0	0	0	0	0	0	0	0	0	0	0

Where: C = Configure select bit
F = Full range bit
Off = When configured to off, individual channels will return 0V.

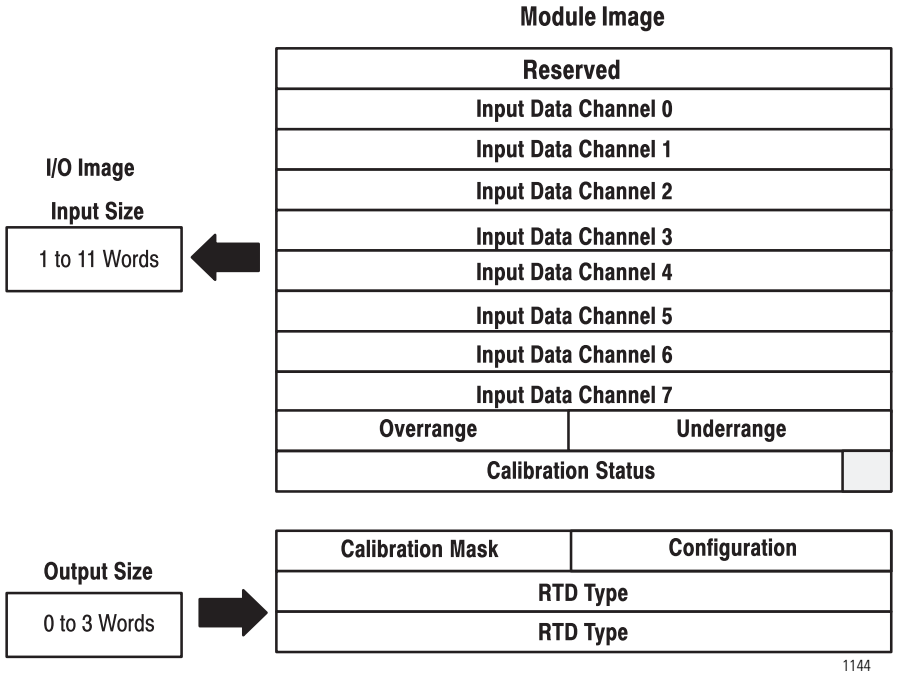
1794-IE4XOE2 Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 0	Bits 00…14 (00…16)	**Channel 0 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 0 analog date sign bit.
Read Word 1	Bits 00…14 (00…16)	**Channel 1 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4...20 mA uses all 16 bits.
	Bit 15 (17)	Channel 1 analog date sign bit.
Read Word 2	Bits 00…14 (00…16)	**Channel 2 Analog Data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA uses all 16 bits.
	Bit 15 (17)	Channel 2 analog data sign bit.
Read Word 3	Bits 00…14 (00…16)	**Channel 3 Analog Data –** 12-bit left justified two's complement number; unused lower bits are zero; 4…20 mA used all 16 bits.
	Bit 15 (17)	Channel 3 analog data sign bit.

1794-IE4XOE2 Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 4	Bit 00…03	**Underrange bits (U)** – for individual channels (4...20 mA current inputs only) -Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on. When set (1), indicates either a broken or open input wire, or input current is @ or below 4 mA.
	Bits 04…05	**Wire Off bits (W)** – Current outputs only – When set (1), the wire on the current output is broken or the load resistance is too high. Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, and so on.
	Bits 06…14 (06…16)	Not used
	Bit 15 (17)	**Power Up bit –** included in Series B modules only. This bit is always 0 in Series A modules. This bit is set to 1 when all bits in the configuration register (write word 3) are 0 (unconfigured state). The configuration register can be cleared by either a reset, or by the user writing all zeroes to it.
Write Word 0	Bits 00…14 (00…16)	**Channel 0 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4...20 mA uses all 16 bits.
	Bit15 (17)	Channel 0 analog date sign bit.
Write Word 1	Bits 00…14 (00…16)	**Channel 1 Analog Data** – 12-bit left justified two's complement number; unused lower bits are zero; 4...20 mA uses all 16 bits.
	Bit15 (17)	Channel 1 analog date sign bit.
Write Word 2	Bits 00…01	**Chx Safe Sate Config** – for individual channels. These bits control the safe state analog outputs. Bit 00 corresponds to output channel 0, bit 01 corresponds to output channel 1. 1 = use words 0 and 1 (analog value) as directed by channel number n 0 = use words 6 and 7 (safe state analog value) as directed by channel n When bits 00...01 are cleared (0) simultaneously by a communication error or user choice through the programmable controller program, word 3 full range and configure select bits are preserved at their last setting.
	Bits 02…15 (02…17)	Not used – set to 0.
Write Word 3	Bits 00…05	**Full Range bits (F)** for individual channels – Bit 00 corresponds to input channel 0, bit 01 corresponds to output channel 1, and so on.
	Bits 06…07	Not used – set to 0.
	Bit 08…13 (10…15)	**Configure Select bits (C)** for individual channels – Bit 08 corresponds to input channel 0, bit 09 (11) corresponds to input channel 1, bit 10 (12) corresponds to input channel 2, bit 11 (13) corresponds to input channel 3, bit 12 (14) corresponds to output channel 0, and bit 13 (15) corresponds to output channel 1. See Table 1794-IE4XOE2 Range Selection Bits on page 26.
	Bits 14…15 (16…17)	Not used – set to 0.
Write Words 4 and 5		Not used – set to 0.

1794-IR8 – RTD Input Analog Module Image Table Mapping



1794-IR8 Memory Map

Decimal Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Reserved																Read Word 0
	Channel 0 Input Data																Read Word 1
	Channel 1 Input Data																Read Word 2
	Channel 2 Input Data																Read Word 3
	Channel 3 Input Data																Read Word 4
	Channel 4 Input Data																Read Word 5
	Channel 5 Input Data																Read Word 6
	Channel 6 Input Data																Read Word 7
	Channel 7 Input Data																Read Word 8
	Overrange bits								Underrange bits								Read Word 9
	0	0	0	0	0	Bad Cal	Cal Done	Cal out of Range	0	Critical Error bits			Pwr Up	0	0	0	Read Word 10
	8-bit Calibration Mask								Cal Clk	Gain Offset Cal	Notch Frequency			Enh	MDT		Write Word 0
	RTD 3 Type				RTD 2 Type				RTD 1 Type				RTD 0 Type				Write Word 1
	RTD 7 Type				RTD 6 Type				RTD 5 Type				RTD 4 Type				Write Word 2

Where: Enh = Enhanced
MDT = Module Data Type

1794-IR8 Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 0	00…15 (00…17)	Reserved
Read Word 1	00…15 (00…17)	Channel 0 Input data
Read Word 2	00…15 (00…17)	Channel 1 Input data
Read Word 3	00…15 (00…17)	Channel 2 Input data
Read Word 4	00…15 (00…17)	Channel 3 Input data
Read Word 5	00…15 (00…17)	Channel 4 Input data
Read Word 6	00…15 (00…17)	Channel 5 Input data
Read Word 7	00…15 (00…17)	Channel 6 Input data
Read Word 8	00…15 (00…17)	Channel 7 Input data
Read Word 9	00…07	**Underrange bits** – these bits are set if the input signal is below the input channel's minimum range.
	08…15 (10…17)	**Overrrange bits** – these bits are set if 1), the input signal is above the input channel's maximum range, or 2), an open detector is detected.
Read Word 10	00…01	Not used – set to 0
	02	Reserved
	03	**Power Up bit –** this bit is set (1) until configuration data is received by the module.
	04…06	**Critical Error bits** – If these bits are anything other than all zeroes, return the module to the factory for repair.
	07	Unused – set to 0
	08 (10)	**Calibration Out of Range bit** – set to 1 if a reference signal is out of range during calibration.
	09 (11)	**Calibration Done bit** – set to 1 after an initiated calibration cycle is complete.
	10 (12)	**Calibration Bad bit** – set to 1 if the channel has not had a valid calibration.
	11…15 (13…17)	Unused – set to 0.

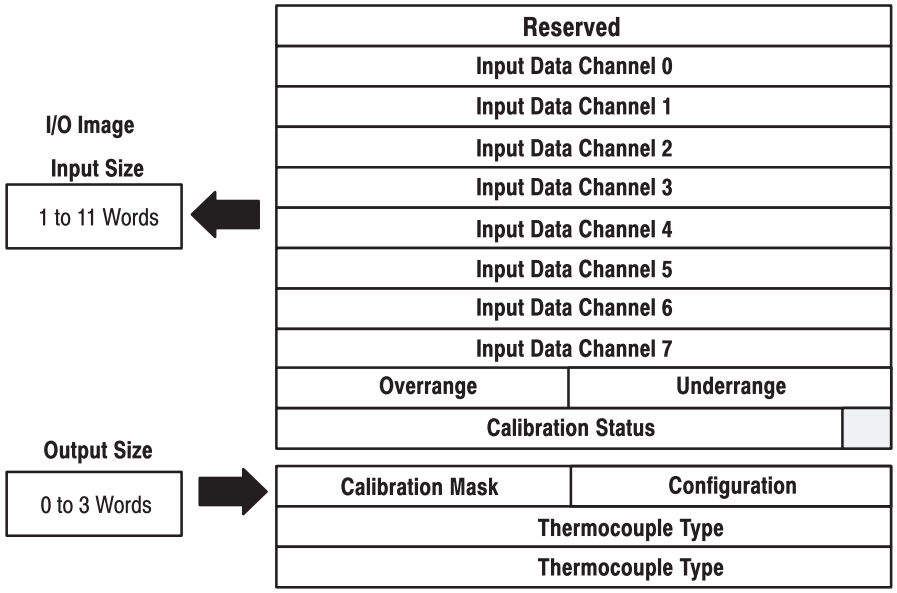
1794-IR8 Word/Bit Descriptions

Word	Dec. Bits (Octal Bits)	Description				
Write Word 0	00…01	**Module Data Type**				
		Bit	**01**	**00**		
			0	0	°C (default)	
			0	1	°F	
			1	0	Bipolar counts scaled between -32768... 32767	
			1	1	Unipolar counts scaled between 0...65535	
	02	**Enhanced mode select** – Measures voltage drop across a precision resistor in the module to compare with the unknown input.				
	03…05	**A/D Filter First Notch Frequency**				
		Bit	**05**	**04**	**03**	**Definition**
			0	0	0	10 Hz (default)
			0	0	1	25 Hz
			0	1	0	50 Hz
			0	1	1	60 Hz
			1	0	0	100 Hz
			1	0	1	250 Hz
			1	1	0	500 Hz
			1	1	1	1000 Hz
	06	**Gain Offset Calibration –** This bit is set during gain calibration/ reset during offset calibration.				
	07	**Calibration Clock** – This bit must be set to 1 to prepare for a calibration cycle; then reset to 0 to initiate calibration.				
	08…15	**Calibration Mask** – The channel, or channels, to be calibrated will have the correct mask bit set. Bit 0 corresponds to channel 0, bit 1 to channel 1, and so on.				

1794-IR8 Word/Bit Descriptions

Write Word 1	00…03	**Channel 0 RTD Type**					
		Bit	**03**	**02**	**01**	**00**	**RTD Type – Range**
			0	0	0	0	Resistance (default)
			0	0	0	1	No sensor connected – do not scan
			0	0	1	0	100 Ω Pt α = 0.00385 Euro (-200...630 °C)
			0	0	1	1	100 Ω Pt α = 0.003916 U.S. (-200...630 °C)
			0	1	0	0	200 Ω Pt α = 0.00385 (-200...630 °C)
			0	1	0	1	500 Ω Pt α = 0.00385 (-200...630 °C)
			0	1	1	0	Reserved
			0	1	1	1	10 Ω Copper (-200...260 °C)
			1	0	0	0	120 Ω Nickel (-60...250 °C)
			1	0	0	1	100 Ω Nickel (-60...250 °C)
			1	0	1	0	200 Ω Nickel (-60...250 °C)
			1	0	1	1	500 Ω Nickel (-60...250 °C)
			1	1	0	0	Reserved
			1101…1111 – Reserved				
	04…07	Channel 1 RTD Type (see bits 00…03)					
	08…11	Channel 2 RTD Type (see bits 00…03)					
	12…15	Channel 3 RTD Type (see bits 00…03)					
Write Word 2	00…03	Channel 4 RTD Type (see write word 2, bits 00…03)					
	04…07	Channel 5 RTD Type (see write word 2, bits 00…03)					
	08…11	Channel 6 RTD Type (see write word 2, bits 00…03)					
	12…15	Channel 7 RTD Type (see write word 2, bits 00…03)					

1794-IT8 – Thermocouple Input Module Image Table Mapping



1794-IT8 Read and Write Words

Dec. Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Reserved																Read Word 0
	Channel 0 Input Data																Read Word 1
	Channel 1 Input Data																Read Word 2
	Channel 2 Input Data																Read Word 3
	Channel 3 Input Data																Read Word 4
	Channel 4 Input Data																Read Word 5
	Channel 5 Input Data																Read Word 6
	Channel 6 Input Data																Read Word 7
	Channel 7 Input Data																Read Word 8
	Overrange Bits								Underrange Bits								Read Word 9
	0	0	0	0	0	Bad Cal	Cal Done	Cal out of Range	0	Critical Error			Pwr Up	Bad TC Type Selected	CJC Over	CJC Under	Read Word 10
	8-bit Calibration Mask								Cal Clk	Gain Offset Cal	Notch Frequency			FFE	Module Data Type		Write Word 0
	Thermocouple3 Type				Thermocouple 2 Type				Thermocouple 1 Type				Thermocouple 0 Type				Write Word 1
	Thermocouple 7 Type				Thermocouple 6 Type				Thermocouple 5 Type				Thermocouple 4 Type				Write Word 2

Where: FFE = Fixed Filter Enable

1794-IT8 Word/Bit Descriptions

Word	Decimal Bit	Definition
Read Word 0	00…15 (00…17)	Reserved
Read Word 1	00…15 (00…17)	Channel 0 Input data
Read Word 2	00…15 (00…17)	Channel 1 Input data
Read Word 3	00…15 (00…17)	Channel 2 Input data
Read Word 4	00…15 (00…17)	Channel 3 Input data
Read Word 5	00…15 (00…17)	Channel 4 Input data
Read Word 6	00…15 (00…17)	Channel 5 Input data
Read Word 7	00…15 (00…17)	Channel 6 Input data
Read Word 8	00…15 (00…17)	Channel 7 Input data
Read Word 9	00…07 (00…07)	**Underrange bits** – These bits are set if the input signal is below the input channel's minimum range.
	08…15 (10…17)	**Overrrange bits** – These bits are set if 1), the input signal is above the input channel's maximum range, or 2), an open detector is detected.
Read Word 10	00	**Not used** – set to 0.
	01	**Cold Junction sensor underrange bit** – This bit is set if the cold junction temperature is below 0 °C.
	02	**Cold Junction sensor overrange bit** – This bit is set if the cold junction temperature is above 70 °C.
	03	**Power Up bit –** This bit is set (1) until configuration data is received by the module.
	04…06	**Critical Fault bits** – If these bits are anything other than zero, return the module to the factory for repair.
	07	Unused – Set to 0.
	08 (10)	**Calibration Out of Range bit** – Set to 1 if a reference signal is out of range during calibration.
	09 (11)	**Calibration Done bit** – Set to 1 after an initiated calibration cycle is complete.
	10 (12)	**Calibration Bad bit** – Set to 1 if the channel has not had a valid calibration.
	11…15 (13…17)	**Unused** – Set to 0.

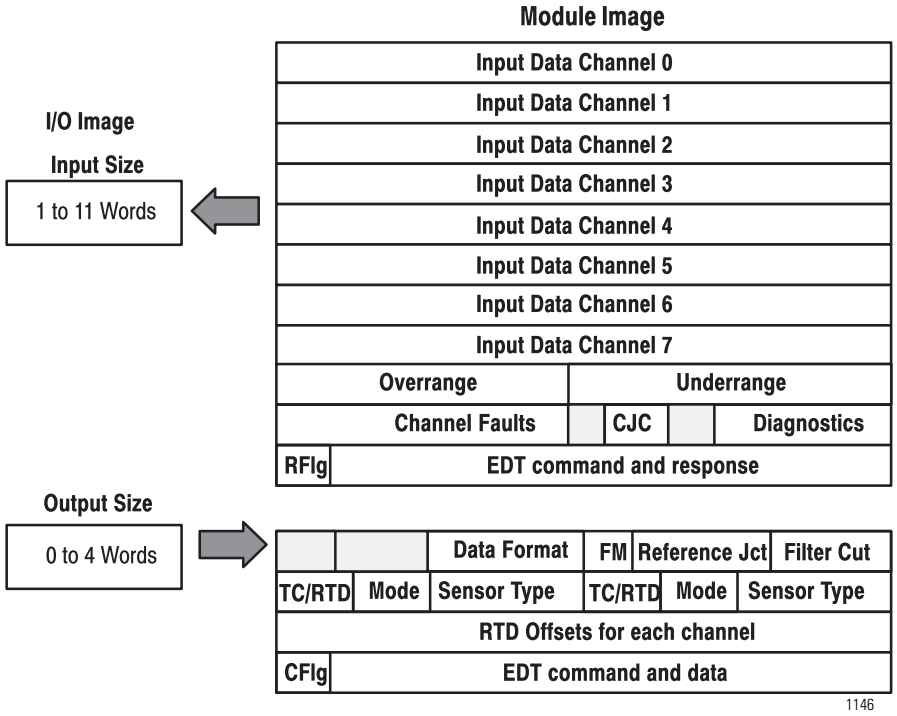
1794-IT8 Word/Bit Description

Word	Dec. Bits (Octal Bits)	Description					
Write Word 0	00…01	**Module Data Type**					
		Bit	**01**	**00**	**Definition**		
			0	0	°C (default)		
			0	1	°F		
			1	0	Bipolar counts scaled between -32768…32767		
			1	1	Unipolar counts scaled between 0…65535		
	02	**Fixed Filter Enable –** When this bit is set (1), a software digital filter is enabled. This filter settles to 100% of a Full Scale step input in 60 scans.					
	03…05	**Notch Frequency**					
		Bit	**05**	**04**	**03**		
			0	0	0	10 Hz (default)	
			0	0	1	25 Hz	
			0	1	0	50 Hz	
			0	1	1	60 Hz	
			1	0	0	100 Hz	
			1	0	1	250 Hz	
			1	1	0	500 Hz	
			1	1	1	1000 Hz	
	06	**Gain Offset Calibration –** This bit is set during gain calibration/ reset during offset calibration.					
	07	**Calibration Clock** – This bit must be set to 1 to prepare for a calibration cycle; then reset to 0 to initiate calibration.					
	08…15 (10…17)	**Calibration Mask** – The channel, or channels, to be calibrated will have the correct mask bit set. Bit 0 corresponds to channel 0, bit 1 to channel 1, and so on.					
Write Word 1	00…03	**Channel 0 Thermocouple Type**					
		Bit	**03**	**02**	**01**	**00**	**Thermocouple Type – Range**
			0	0	0	0	Millivolts (default)
			0	0	0	1	B 300...1800 °C (572...3272 °F)
			0	0	1	0	E -270...1000 °C (-454...1835 °F)
			0	0	1	1	J -210...1200 °C (-346...2192 °F)
			0	1	0	0	K -71...1372 °C (-95...2502 °F)
			0	1	0	1	R -50...1768 °C (-58...3214 °F)
			0	1	1	0	S -50...1768 °C (-58...3214 °F)
			0	1	1	1	T -73...400 °C (-99...752 °F)
			1	0	0	0	C 0...2315 °C (32...4199 °F)
			1	0	0	1	N -270...1300 °C (-450...2372 °F)

1794-IT8 Word/Bit Description

Word	Dec. Bits (Octal Bits)	Description					
Write Word 1	00…03	**Channel 0 Thermocouple Type**					
		Bit	**03**	**02**	**01**	**00**	**Thermocouple Type – Range**
			1	0	1	0	TXK/XK(L) -200...800 °C (-328...1472 ·F)
			1	0	1	1	Reserved
			1	1	0	0	Module reports cold junction sensor temperature for channels 00…03
			1	1	0	1	Module reports cold junction sensor temperature for channels 04…07
			1	1	1	0	Reserved
			1	1	1	1	No input device connected (do not scan)
	04…07	Channel 1 Thermocouple Type (see bits 00…03)					
	08…11	Channel 2 Thermocouple Type (see bits 00…03)					
	12…15	Channel 3 Thermocouple Type (see bits 00…03)					
Write Word 2	00…03	Channel 4 Thermocouple Type (see write word 13, bits 00…03)					
	04…07	Channel 5 Thermocouple Type (see write word 13, bits 00…03)					
	08…11	Channel 6 Thermocouple Type (see write word 13, bits 00…03					
	12…15	Channel 7 Thermocouple Type (see write word 13, bits 00…03)					

1794-IRT8 – Thermocouple/RTD Input Module Image Table Mapping



1794-IRT8 Thermocouple/RTD/mV Input Module Read Words

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	Read/Write Words
Channel 0 Input Data																Read 0
Channel 1 Input Data																Read 1
Channel 2 Input Data																Read 2
Channel 3 Input Data																Read 3
Channel 4 Input Data																Read 4
Channel 5 Input Data																Read 5
Channel 6 Input Data																Read 6
Channel 7 Input Data																Read 7
Overrange Alarm bits (channel 0 = bit 08, and so on)								Underrange Alarm bits (channel 0 = bit 00, and so on)								Read 8
Ch7 Fault	Ch6 Fault	Ch5 Fault	Ch4 Fault	Ch3 Fault	Ch2 Fault	Ch1 Fault	Ch0 Fault		CJC 2 Alarm	CJC 1 Alarm		Diagnostic Status				Read 9
	EDT command response							EDT response data								Read 10
Not used				Data Format				Fault Mode Ch 0…3	Fault Mode Ch 4…7	Reference Jct.		Filter Cutoff				Write 0

1794-IRT8 Thermocouple/RTD/mV Input Module Read Words

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	Read/Write Words
Sensor Ch 4…7		Sensor Mode Ch 4…7		Sensor Type Ch 4…7				Sensor Ch 0…3		Sensor Mode Ch 0…3		Sensor Type Ch 0…3				Write 1
RTD Offset Ch 7		RTD Offset Ch 6		RTD Offset Ch 5		RTD Offset Ch 4		RTD Offset Ch 3		RTD Offset Ch 2		RTD Offset Ch 1		RTD Offset Ch 0		Write 2
	EDT command							EDT command data								Write 3

1794-IRT8 Word/Bit Descriptions for Block Transfer Words

Word	Decimal Bit	Definition
Read Word 0	00…15 (00…17)	Channel 0 Input data
Read Word 1	00…15 (00…17)	Channel 1 Input data
Read Word 2	00…15 (00…17)	Channel 2 Input data
Read Word 3	00…15 (00…17)	Channel 3 Input data
Read Word 4	00…15 (00…17)	Channel 4 Input data
Read Word 5	00…15 (00…17)	Channel 5 Input data
Read Word 6	00…15 (00…17)	Channel 6 Input data
Read Word 7	00…15 (00…17)	Channel 7 Input data
Read Word 8	00…07	**Underrange bits** – These bits are set if the input signal is below the input channel's minimum range. Bit 00 corresponds to channel 0, bit 01 corresponds to channel 1, and so on.
	08…15 (10…17)	**Overrange bits** – These bits are set if 1), the input signal is above the input channel's maximum range, or 2), an open detector is detected. Bit 08 (10) corresponds to channel 0, bit 09 (11) corresponds to channel 1, and so on.

1794-IRT8 Word/Bit Descriptions for Block Transfer Words

Word	Dec. Bits (Octal Bits)	Description					
Write Word 0	00…02	**Inpt Filter Cutoff Bits**					
		Bit	**02**	**01**	**00**	Filter Time Constants – Actual filtering depends on the module's mode of operation.	
			0	0	0	Hardware filtering only (default filtering).	
			0	0	1	25 ms	
			0	1	0	100 ms	
			0	1	1	250 ms	
			1	0	0	500 ms	
			1	0	1	1 s	
			1	1	0	2 s	
			1	1	1	5 s	
	03…05	**Reference Junction** – Used when input type is set to thermocouple and sensor mode is set to internal compensation. Sets a fixed reference junction to compensate all thermocouple channels.					
		Bit	**05**	**04**	**03**	**Reference Junction**	
			0	0	0	0 °C	
			0	0	1	20 °C	
			0	1	0	25 °C	
			0	1	1	30 °C	
			1	0	0	40 °C	
			1	0	1	50 °C	
			1	1	0	60 °C	
			1	1	1	70 °C	
	06…07	**Fault Mode Bits** – When a bit is set (1), fault mode is enabled for that channel. Bit 06 corresponds to channels 0…3; bit 07 corresponds to channels 4…7. 0 = disabled 1 = enable wire-off detection					
	08…11 (10…13)	**Data Format** – Module defaults to -4000...10000 in millivolt mode, and 0...5000 in ohms mode with implied decimal points (for example -40.00, 0.0 Ω).					
		Bit	**11**	**10**	**09**	**08**	**Data type for channels 0-7**
			0	0	0	0	°C (implies decimal point XXXX.X)
			0	0	0	1	°F (implies decimal point XXXX.X)
			0	0	1	0	°K (implies decimal point XXXX.X)
			0	0	1	1	-32767...3267
			0	1	0	0	0...65535
			0101...1111 not used				
	12…15 (14…17)	Not used					

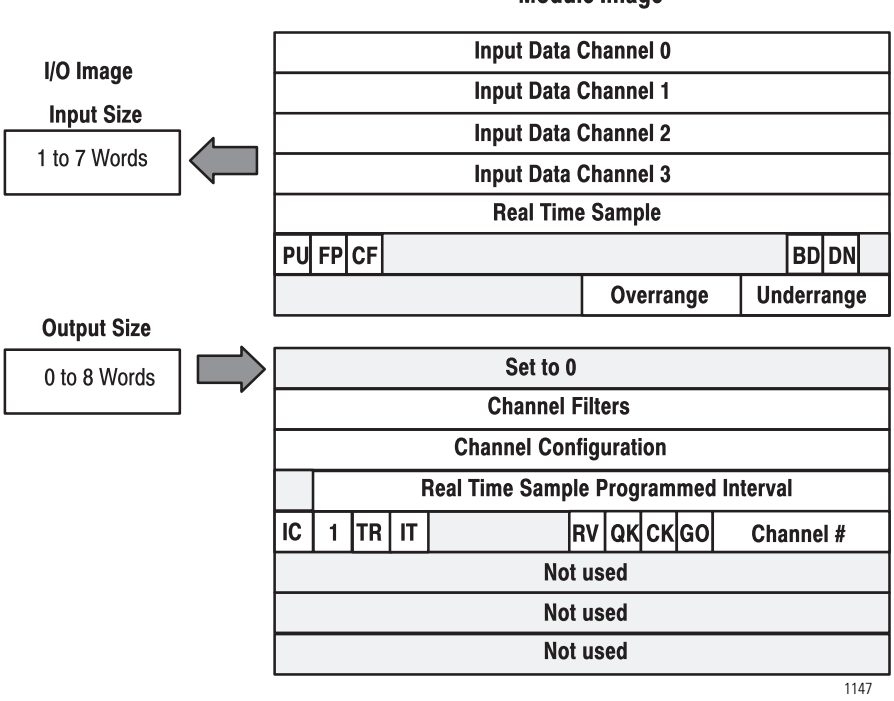
Word	Dec. Bits (Octal Bits)	Description					
Write Word 1	00…03	**Sensor Type (Thermocouple or RTD)**					
		RTD Type					
		Bit	**03**	**02**	**01**	**00**	Sensor type for channels 0…3
			0	0	0	0	Resistance (default)
			0	0	0	1	100 Ω Pt α = 0.00385 Euro (-200...870 °C)
			0	0	1	0	200 Ω Pt α = 0.00385 Euro (-200...400 °C)
			0	0	1	1	100 Ω Pt α = 0.003916 U.S. (-200...630 °C)
			0	1	0	0	200 Ω Pt α = 0.003916 U.S. (-200...400 °C)
			0	1	0	1	100 Ω Nickle (-60...250 °C)
			0	1	1	0	200 Ω Nickle (-60...200 °C)
			0	1	1	1	120 Ω Nickle (-80...320 °C)
			1	0	0	0	10 Ω Copper (-200...260 °C)
		1001...1111 not used					
	00…03	**Thermocouple Type**					
		Bit	**03**	**02**	**01**	**00**	Sensor type for channels 0...3
			0	0	0	0	mV (default)
			0	0	0	1	B 300...1800 °C (572...3272 °F)
			0	0	1	0	E -270...1000 °C (-454...1835 °F)
			0	0	1	1	J -210...1200 °C (-346...2192 °F)
			0	1	0	0	K -270...1372 °C (-454...2502 °F)
			0	1	0	1	TXK/XK(L) -200...800 °C (-328...1472 °F)
			0	1	1	0	N -270...1300 °C (-450...2372 °F)
			0	1	1	1	R -50...1768 °C (-58...3214 °F)
			1	0	0	0	S -50...1768 °C (-58...3214 °F)
			1	0	0	1	T -270...400 °C (-454...752 °F)
			1010...1111 not used				

Word	Dec. Bits (Octal Bits)	Description					
Write Word 1	04…05	**Sensor Mode Select bits**					
		Bit	**05**	**04**	Sensor mode select for channels 0...3		
		Thermocouple					
			0	0	External compensation – uses cold junction sensors		
			0	1	Internal compensation – uses the value selected for "reference junction selection"		
			1	0	No compensation (Data is referenced to 0 °C)		
			1	1	Differential measurement between 2 channels (0…1, 2…3, 4…5, 6…7)		
		RTD					
			0	0	1-wire RTD no compensation		
			0	1	2-wire RTD with user selected compensation		
			1	0	3-wire RTD		
			1	1	4-wire RTD		
	06…07	**Sensor**					
		Bit	**07**	**06**	Input type selection for channels 0…3		
			0	0	Thermocouple		
			0	1	RTD		
			1	0	Not used		
			1	1			
	08…11 (10…13)	**Sensor Mode Select bits**					
		RTD Type					
		Bit	**11**	**10**	**09**	**08**	Sensor type for channels 4...7
			0	0	0	0	Resistance (default)
			0	0	0	1	100 Ω Pt α = 0.00385 Euro (-200...870 °C)
			0	0	1	0	200 Ω Pt α = 0.00385 Euro (-200...400 °C)
			0	0	1	1	100 Ω Pt α = 0.003916 U.S. (-200...630 °C)
			0	1	0	0	200 Ω Pt α = 0.003916 U.S. (-200...400 °C)
			0	1	0	1	100 Ω Nickle (-60...250 °C)
			0	1	1	0	200 Ω Nickle (-60...200 °C)
			0	1	1	1	120 Ω Nickle (-80...320 °C)
			1	0	0	0	10 Ω Copper (-200...260 °C)
			1001...1111 not used				

Word	Dec. Bits (Octal Bits)	Description					
Write Word 1	08…11 (10…13)	**Thermocouple Type**					
		Bit	**11**	**10**	**09**	**08**	Sensor type for channels 4...7
			0	0	0	0	mV (default)
			0	0	0	1	B 300...1800 °C (572...3272 °F)
			0	0	1	0	E -270...1000 °C (-454...1835 °F)
			0	0	1	1	J -210...1200 °C (-346...2192 °F)
			0	1	0	0	K -270...1372 °C (-454...2502 °F)
			0	1	0	1	TXK/XK(L) -200...800 °C (-328...1472 °F)
			0	1	1	0	N -270...1300 °C (-450...2372 °F)
			0	1	1	1	R -50...1768 °C (-58...3214 °F)
			1	0	0	0	S -50...1768 °C (-58...3214 °F)
			1	0	0	1	T -270...400 °C (-454...752 °F)
			1010...1111 not used				
	12…13 (14…15)	**Sensor Mode Select bits**					
		Bit	13	12	Sensor mode select for channels 4…7		
		Thermocouple Type					
			0	0	External compensation – uses cold junction sensor.		
			0	1	Internal compensation – uses the value selected for reference junction.		
			1	0	No compensation (Data is referenced to 0 °C).		
			1	1	Differential measurement between 2 channels.		
		RTD					
			0	0	2-wire RTD no compensation.		
			0	1	2-wire RTD with loop resistance compensation.		
			1	0	3-wire RTD.		
			1	1	4-wire RTD.		
	14…15 (16…17)	**Sensor**					
		Bit	**15**	**14**	**Input type selection for channels 4…7**		
			0	0	Thermocouple.		
			0	1	RTD.		
			1	0	Not used.		
			1	1			

Word	Dec. Bits (Octal Bits)	Description			
Write Word 2	00…15 (00…17)	**RTD Loop Resistance Offset S bits –** used when input type is set to RTD and sensor mode select is set to 2-wire with loop resistance compensation. Allows you to set the type of RTD loop resistance compensation used for all RTDs or one of three fixed values for all channels. **NOTE**: Not applicable to 10 Ω copper RTD, which defaults to 0 Ω.			
		Bit	01	00	RTD channel 0.
		Bit	03	02	RTD channel 1.
		Bit	05	04	RTD channel 2.
		Bit	07	06	RTD channel 3.
		Bit	09	08	RTD channel 4.
		Bit	11	10	RTD channel 5.
		Bit	13	12	RTD channel 6.
		Bit	15	14	RTD channel 7.
			0	0	Use channel loop compensation value stored during calibration procedure for 2-wire RTD (default = 0 Ω).
			0	1	5 Ω
			1	0	10 Ω
			1	1	15 Ω
Write Word 3	00…07	**Extended Data Table Command bits** – These bits are written to the module during calibration. They are used to define offset, gain and general channel calibration.			
	08…14 (10…16)	**Extended Data Table Command bits** – These bits are written to the module during calibration. They are used to select channel calibration action.			
	15 (17)	Reserved for factory use only.			

1794-IF4I – 4-Input Isolated Analog Module Image Table Mapping



1794-IF4I Isolated Analog Input Module Read Words

Dec. Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**	**Read/Write Words**
	Analog Value Channel 0																Read Word 0
	Analog Value Channel 0																Read Word 1
	Analog Value Channel 0																Read Word 2
	Analog Value Channel 0																Read Word 3
	Real Time Sample																Read Word 4
	PU	FP	CF	0	Reserved				0	0	0	0	0	BD	DN	0	Read Word 5
	0	0	0	0	0	0	0	0	V3	V2	V1	V0	U3	U2	U1	U0	Read Word 6
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Write Word 0
	Chnl 3 Filter				Chnl 2 Filter				Chnl 1 Filter				Chnl 0 Filter				Write Word 1
	Chnl 3 Configuration				Chnl 2 Configuration				Chnl 1 Configuration				Chnl 0 Configuration				Write Word 2
	0	Real Time Sample Programmed Interval															Write Word 3
	IC	1	TR	IT	0	0	0	0	RV	QK	CK	GO	Channel Number				Write Word 4
	Not used																Write Word 5
	Not used																Write Word 6
Word 7	Not used																Write Word 7

1794-IF4I Isolated Analog Input Module Read Words

Dec. Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	Size
Octal Bit	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00	Read/Write Words

Where:
PU = Power up unconfigured state
FP = Field power off
CF = Configuration mode
BD = Calibration bad
DN = Calibration done
U = Underrange for specified channel
V = Overrange for specified channel
IC = Initiate configuration bit
TR = Transparent bit
IT = Interrupt toggle bit
RV = Revert to defaults bit
QK = Quick calibration
CK = Calibration clock
GO = Gain offset select

Setting the Input Filter

Bits				Channel	
03	02	01	00	Input 0	
07	06	05	04	Input 1	
11	10	09	08	Input 2	
15	14	13	12	Input 3	
				A/D Conversion Rate	Low Pass Filter
0	0	0	0	1200 Hz	No low pass
0	0	0	1	1200 Hz	100 ms low pass
0	0	1	0	1200 Hz	500 ms low pass
0	0	1	1	1200 Hz	1000 ms low pass
0	1	0	0	600 Hz	No low pass
0	1	0	1	600 Hz	100 ms low pass
0	1	1	0	600 Hz	500 ms low pass
0	1	1	1	600 Hz	1000 ms low pass
1	0	0	0	300 Hz	No low pass
1	0	0	1	300 Hz	100 ms low pass
1	0	1	0	300 Hz	500 ms low pass
1	0	1	1	300 Hz	1000 ms low pass
1	1	0	0	150 Hz	No low pass
1	1	0	1	150 Hz	100 ms low pass
1	1	1	0	150 Hz	500 ms low pass
1	1	1	1	150 Hz	1000 ms low pass

Configuring Your Input Channel

Input Channel Configuration										
03	02	01	00	Set these bits for Channel 0.						
07	06	05	04	Set these bits for Channel 1.						
11	10	09	08	Set these bits for Channel 2.						
15	14	13	12	Set these bits for Channel 3.						
Bit Settings				**Input Values**	**Data Format**	**% Underrange/ % Overrange**	**Input Range[2] Hexadec.**	**Dec.**	**Module Update Rate (RTSI = 0) (RTSI = 0), IT = 1**	
0	0	0	0	Channel not configured						
0	0	0	1	4...20 mA	signed 2's complement	4% Under; 4% Over	<0000...7878>	<0000...30840>	7.5 ms	5.0 ms
0	0	1	0	± 10V	signed 2's complement	2% Under; 2% Over	<831F...7CE1>	<-31969...31969>	2.5 ms	2.5 ms
0	0	1	1	± 5V	signed 2's complement	4% Under; 4% Over	<8618...79E8>	<-31208...31208>	2.5 ms	2.5 ms
0	1	0	0	0...20 mA	signed 2's complement %	0% Under; 4% Over	<0...2710>	<0...10000>	7.5 ms	5.0 ms
0	1	1	0	0...10V	signed 2's complement %	0% Under; 2% Over	<0...2710>	<0...10000>	5.0 ms	5.0 ms
0	1	1	1	± 10V	singed 2's complement %	2% Under; 2% Over	<-D8F0...2710>	<-10000...10000>	5.0 ms	5.0 ms
1	0	0	0	0...20 mA	binary	0% Under; 4% Over	<0000...F3CF>	<0000...62415>	2.5 ms	2.5 ms
1	0	0	1	4...20 mA[1]	binary	4% Under; 4% Over	<0000...F0F1>	<0000...61681>	7.5 ms	5.0 ms
1	0	1	0	0...10V	binary	0% Under; 2% Over	<0000...F9C2>	<0000...63938>	2.5 ms	2.5 ms
1	0	1	1	0...5V	binary	0% Under; 4% Over	<0000...F3CF>	<0000...62415>	2.5 ms	2.5 ms
1	1	0	0	± 20 mA	offset binary, 8000H = 0 mA	4% Under; 4% Over	<0618...F9E8>	<1560...63976>	2.5 ms	2.5 ms
1	1	0	1	4...20 mA	offset binary, 8000H = 4 mA	4% Under; 4% Over	<8000...F878>	<32768...63608>	7.5 ms	5.0 ms
1	1	1	0	± 10V	offset binary, 8000H = 0V	2% Under; 2% Over	<031F...FCE1>	<799...64737>	2.5 ms	2.5 ms
1	1	1	1	± 5V	offset binary, 8000H = 0V	4% Under; 4% Over	<0618...F9E8>	<1560...63976>	2.5 ms	2.5 ms

(1) Underrange for 4...20 mA occurs in the blind area below 0 (3.2 mA).

(2) <and> indicates the overrun beyond actual range (about 5%).

1794-IF4I Isolated Analog Input Module Word/Bit Descriptions

Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bit 00…15 (00…17)	**Channel 0 Analog Data** – Real time input data per your configuration.
Read Word 1	Bit 00…15 (00…17)	**Channel 1 Analog Data** – Real time input data per your configuration.
Read Word 2	Bit 00…15 (00…17)	**Channel 2 Analog Data** – Real time input data per your configuration.
Read Word 3	Bit 00…15 (00…17)	**Channel 3 Analog Data** – Real time input data per your configuration.
Read Word 4	Bit 00…15 (00…17)	**Real Time Sample** – the elapsed time in increments programmed by the real time sample interval.

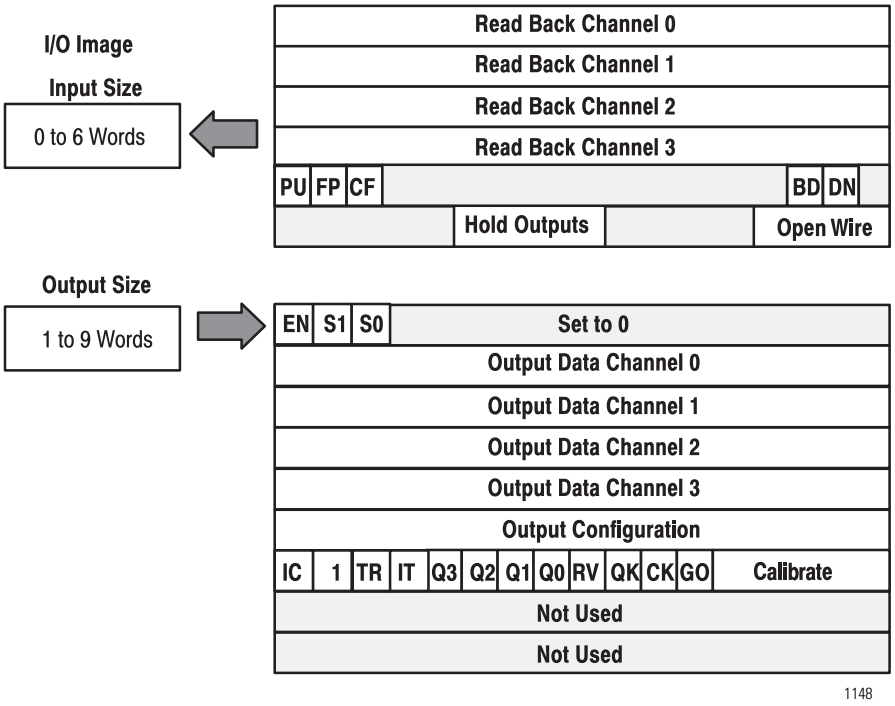
1794-IF4I Isolated Analog Input Module Word/Bit Descriptions

Word	Decimal Bit (Octal Bit)	Definition
Read Word 5	Bit 00	Reserved.
	Bit 01	**Calibration Done bit (DN) –** This bit is set to 1 after a calibration cycle is completed.
	Bit 02	**Calibration Bad bit (BD)** – This bit is set to 1 if the channel calibration coefficients cannot be saved or be read properly.
	Bits 03…07	Set to 0.
	Bits 08…11 (10…12)	Reserved.
	Bit 12 (14)	Set to 0.
	Bit 13 (15)	**Configuration Mode bit (CF)** – This bit is set (1) when the calibration mode is selected (bit 15, word 5 in the block transfer write set to 1). When this bit is set (1), the module status indicator flashes.
	Bit 14 (16)	**Field Power Off bit (FP)** – This bit is set (1) when the 24V field power fails. When this bit is set (1), the module status indicator flashes.
	Bit 15 (17)	**Power Up (unconfigured state) bit (PU) –** This bit is set (1) when the configuration word is all zeroes (0) due to a reset (adapter power cycle or module insertion) or a cleared configuration word (all 0). When this bit is set (1), the module status indicator flashes.
Read Word 6	Bits 00…03	**Underrange bits (U)** -These bits are set (1) when the input channel is below a preset limit as defined by the configuration selected. U0 (bit 00) corresponds to input channel 0 and U1 (bit 01) corresponds to input channel 1, and so on. See Configuring Your Input Channel on page 45.
	Bits 04…07	**Overrange bits (V)** – These bits are set (1) when the input channel is above a preset limit as defined by the configuration selected. Bit 04 corresponds to input channel 0 and bit 05 corresponds to input channel 1, and so on. See Configuring Your Input Channel on page 45.
	Bits 08…15 (10…17)	Not used. Set to 0.
Write Word 0	Bits 00…14 (00…16)	Not used. Set to 0.
Write Word 1	**Channels 0...3 Filter Selections (refer to Setting the Input Filter)**	
	Bits 00…03	Channel 0 Filter Setting.
	Bits 04…07	Channel 1 Filter Setting.
	Bits 08…11 (10…13)	Channel 2 Filter Setting.
	Bits 12…15 (14…17)	Channel 3 Filter Setting.
Write Word 2	Channel Configuration (See Configuring Your Input Channel on page 45.)	
	Bits 00…03	Channel 0 Configuration.
	Bits 04…07	Channel 1 Configuration.
	Bits 08…11 (10…13)	Channel 2 Configuration.
	Bits 12…15 (14…17)	Channel 3 Configuration.
Write Word 3	Bits 00…14 (00…16)	**Real Time Sample Interval** – Programs the interval of the real time sample. Can be varied from 0...30 s (3000 decimal). Resolution is in ms with granularity in 5 ms steps.
	Bit 15 (17)	Not used. Set to 0.

1794-IF4I Isolated Analog Input Module Word/Bit Descriptions

Word	Decimal Bit (Octal Bit)	Definition
Write Word 4	Bit 00…03	**Channel Calibration Selection bit**. – When this bit is set (1), the channel can be calibrated using the calibration clock bit (CK). Bit 00 corresponds to input channel 0, bit 01 corresponds to channel 1, bit 02 corresponds to input channel 2, bit 03 corresponds to input channel 3.
	Bit 04	**Gain/Offset Calibration bit (GO)** – When this bit is cleared, a 0...1...0 transition of the CK bit performs on offset calibration. When this bit is 1, the module is directed to do a gain calibration.
	Bit 05	**Calibration Clock bit (CK)** – When this bit is set to 1 (calibration mode), the calibration coefficient for the selected channels is accepted. When this bit is reset (0), the accepted calibration coefficients for the selected channels are stored, applied, and the calibration mode exited. Monitor status bits DN and BD for successful calibration.
	Bit 06	**Quick Calibration bit (QK)** – Normally reset (0). When this bit is set (1) during a calibration sequence, the calibration coefficient is stored to all related configurations for the selected channels. **NOTE:** This method of calibration quickly calibrates the selected channels, however you will not be within the rated accuracy of the module.
	Bit 07	**Revert to Defaults bits (RV)** – Normally reset (0). When set (1) during a calibration procedure, default values for selected channels are used for the calibration coefficient. **NOTE:** You will not be within the rated accuracy of the module.
	Bit 08…11 (10…14)	Not used. Set to 0.
	Bit 12 (14)	**Interrupt Toggle bit (IT)** – This bit, when set (1), permits interleaving of module interrupts ensuing exchange of critical data when channels are configured for their fastest update times. RTSI and "no low pass filter" must be 0 in order for the module to recognize this feature. This groups data update rates for all channels to the slowest configuration setting of any of the channels. In addition, channel update rates for all channels with a 7.5 ms update rate are reduced to 5.0 ms. When reset (0), real time sampling and filter features are enabled.
	Bit 13 (15)	**Transparent bit (TR)** – This bit, when set to 1, permits configuration to be changed without using the IC bit.
	Bit 14 (16)	Set to 1.
	Bit 15 (17)	**Initiate Configuration bit (IC)** – When set (1), instructs the module to enter configuration mode. Present configuration data prior to or coincident with IC being set. Once IC returns to 0, the configuration is applied and any subsequent configuration information is ignored until IC is toggled.
Write Words 5…7	Bits 00…15 (00…17)	Not used.

1794-OF4I – 4-Output Isolated Analog Module Image Table Mapping



1794-OF4I Isolated Analog Output Module Read Words

Word/Dec. Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Word/Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Read Word 0	Read Back Channel 0															
Read Word 1	Read Back Channel 1															
Read Word 2	Read Back Channel 2															
Read Word 3	Read Back Channel 3															
Read Word 4	PU	FP	CF	0	Reserved				0	0	0	0	0	BD	DN	0
Read Word 5	0	0	0	0	P3	P2	P1	P0	0	0	0	0	W3	W2	W1	W0
Write Word 0	EN	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0
Write Word 1	Output Data – Channel 0															
Write Word 2	Output Data – Channel 1															
Write Word 3	Output Data – Channel 2															
Write Word 4	Output Data – Channel 3															
Write Word 5	Output Ch 3 Configuration				Output Ch 2 Configuration				Output Ch 1 Configuration				Output Ch 0 Configuration			

1794-OF4I Isolated Analog Output Module Read Words

Word/Dec. Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word/Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Write Word 6	IC	1	TR	IT	Q3	Q2	Q1	Q0	RV	QK	CK	GO	Channel Number			
Write Words 7 and 8	Not used															

Where:

PU = Power up unconfigured state
FP = Field power off
CF = In configuration mode
BD = Calibration bad
OR = Reference calibration signal is out of range
P0...P3 = Output holding in response to Q0...Q3
W0...W3 =Wire off current loop status for channels 0...3 respectively — Not used on voltage outputs.
EN = Enable outputs; 0 = output follows S1/S0, 1 = output enabled
IC = Initiate configuration bit
TR = Transparent bit
IT = Interleave Interrupts
Q0...Q3 = Request for outputs to hold
RV = Revert to defaults bit
QK = Quick calibration
CK = Calibration clock
GO = Gain offset calibration

1794-OF4I – Isolated Output Module Output Configuration

Configuration Bits MSD			LSD	Nominal Range	Data Type	Output Values[1] Hexadecimal	Decimal	Update Rate
0	0	0	1	4...20 mA	2's complement	<0000..7878>	<0000...30840>	5.0 ms
0	0	1	0	±10V	2's complement	<831F...79E8>	<-31208...31208>	2.5 ms
0	0	1	1	±5V	2's complement	<8618...79E8>	<-31208...31208>	2.5 ms
0	1	0	0	0...20 mA	2's complement %	<0...2710>	<0...10000>	5.0 ms
0	1	0	1	4...20V	2's complement %	<0...2710>	<0...10000>	5.0 ms
0	1	1	0	0...10V	2's complement %	<0...2710>	<0...10000>	5.0 ms
0	1	1	1	± 10V	2's complement	<-D8F0...2710>	<-10000...10000>	5.0 ms
1	0	0	0	0...20 mA	binary	<0000...F3CF>	<0000...62415>	2.5 ms
1	0	0	1	4...20 mA	binary	<0000...F0F1>	<0000...61681>	5.0 ms
1	0	1	0	0...10V	binary	<0000...F3CF>	<0000...62415>	2.5 ms
1	0	1	1	0...5V	binary	<0000...F3CF>	<0000...62415>	2.5 ms
1	1	0	0	±2 0 mA	offset binary	<0000...F9E8>	<0000...63976>	2.5 ms
1	1	0	1	4...20 mA	offset binary	<8000...F878>	<32768...63608>	5.0 ms
1	1	1	0	± 10V	offset binary	<0618...F9E8>	<1560...63976>	2.5 ms
1	1	1	1	± 5V	offset binary	<0618...F9E8>	<1560...63976>	2.5 ms

(1) < and > indicate the overrun beyond actual range (about 5%).

1794-IF4I Isolated Analog Input Module Word/Bit Descriptions

Read Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bit 00…15 (00…17)	**Read Back Channel 0** – During normal operation, it is a copy of the output of channel 0. During an EN transition, it is the condition of the output as determined by S1 and S0. Read back is an image of what the user has sent as output to the module; no checks are performed on the data.
Read Word 1	Bit 00…15 (00…17)	**Read Back Channel 1** – During normal operation, it is a copy of the output of channel 1. During an EN transition, it is the condition of the output as determined by S1 and S0. Read back is an image of what the user has sent as output to the module; no checks are performed on the data.
Read Word 2	Bit 00…15 (00…17)	**Read Back Channel 2** – During normal operation, it is a copy of the output of channel 2. During an EN transition, it is the condition of the output as determined by S1 and S0. Read back is an image of what the user has sent as output to the module; no checks are performed on the data.
Read Word 3	Bit 00…15 (00…17)	**Read Back Channel 3** – During normal operation, it is a copy of the output of channel 3. During an EN transition, it is the condition of the output as determined by S1 and S0. Read back is an image of what the user has sent as output to the module; no checks are performed on the data.
Read Word 4	Bit 00	Reserved.
	Bit 01	**Calibration Done bit (DN) –** This bit is set to 1 after a calibration cycle is completed.
	Bit 02	**Calibration Bad bit (BD)** – This bit is set to 1 if the channel calibration coefficients cannot be saved or be read properly.
	Bits 03…07	Set to 0.
	Bits 08…11 (10…12)	Reserved.
	Bit 12 (14)	Set to 0.
	Bit 13 (15)	**Configuration Mode bit (CF)** – This bit is set (1) when the calibration mode is selected (bit 15, word 5 in the block transfer write set to 1). When this bit is set (1), the module status indicator flashes.
	Bit 14 (16)	**Field Power Off bit (FP)** – This bit is set (1) when the 24V field power fails. When this bit is set (1), the module status indicator flashes.
	Bit 15 (17)	**Power Up (unconfigured state) bit (PU) –** This bit is set (1) when the configuration word is all zeroes (0) due to a reset (adapter power cycle or module insertion) or a cleared configuration word (all 0). When this bit is set (1), the module status indicator flashes.
Read Word 5	Bits 00…03	**Wire-off Status bits (W)** – These bits, when set (1), indicate the corresponding current output channel is open. W0 corresponds to channel 0, W1 corresponds to channel 2, and so on.
	Bits 04…07	Set to 0.
	Bits 10…11 (12…13)	**Hold Output bits (P)** – These bits are set (1) in response to Q0 or Q1 and a transition of the EN bit. When P0 or P1 is set (1), they indicate that the output is holding at the level in the readback data for the respective channel. These bits return to 0 when the output data matches the readback output data.
	Bits 12…15 (13…17)	Set to 0.

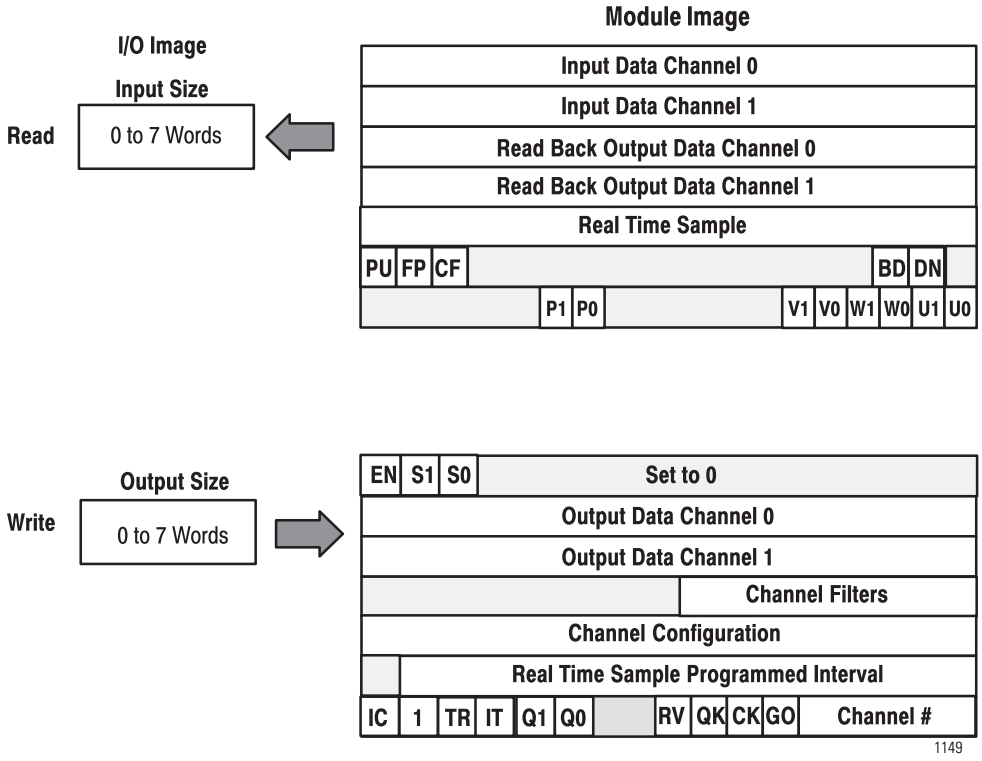
1794-IF4I Isolated Analog Input Module Word/Bit Descriptions

Write Word	Decimal Bit (Octal Bit)	Definition
Write Word 0	Bit 00…12 (00…14)	Not used.
	Bit 13…14 (15…16)	**Safe State Configure (S1/S0)** – When EN is 0, these bits designate the source of the safe state data. Bit 13 = 0, bit 14 = 1 – reset outputs to 0V/0mA (used with 1794-ASB/C) Bit 13 = 1, bit 14 = 1 – hold output at its current level (used with 1794-ASB/C) Bit 13 = 0, bit 14 = 0 – Safe state data is in output data words
	Bit 15 (17)	**Output Enable bit (EN)** – When set (1), the outputs are enabled. This bit must be set in order for the real time data to appear at the outputs. If this bit is not set (0), the outputs will be determined by S1/S0.
Write Word 1	Bit 00…15 (00…17)	**Channel 0 output data** – The output data is real time data formatted to the selected configuration. This data is also safe state data when directed by S1 and S0.
Write Word 2	Bit 00…15 (00…17)	**Channel 1 output data** – The output data is real time data formatted to the selected configuration. This data is also safe state data when directed by S1 and S0.
Write Word 3	Bit 00…15 (00…17)	**Channel 2 output data** – The output data is real time data formatted to the selected configuration. This data is also safe state data when directed by S1 and S0.
Write Word 4	Bit 00…15 (00…17)	**Channel 3 output data** – The output data is real time data formatted to the selected configuration. This data is also safe state data when directed by S1 and S0.
Write Word 5	**Channel Configuration** (see 1794-OF4I Isolated Analog Output Module Read Words on page 48)	
	Bits 00…03	**Channel 0 Configuration**
	Bit 04…07	**Channel 1 Configuration**
	Bit 08…11 (10…13)	**Channel 2 Configuration**
	Bit 12…15 (14…17)	**Channel 3 Configuration**

1794-IF4I Isolated Analog Input Module Word/Bit Descriptions

Write Word	Decimal Bit (Octal Bit)	Definition
Write Word 6	Bits 00…03	**Calibrate bit –** When this bit is set (1), the channel can be calibrated using the calibration clock bit (CK). Bit 00 corresponds to output channel 0, bit 01 corresponds to output channel 1, bit 02 corresponds to output channel 3, bit 03 corresponds to output channel 4.
	Bit 04	**Gain/Offset Calibration bit (GO)** – When this bit is cleared, a 0 to 1 to 0 transition of the CK bit performs on offset calibration. When this bit is set (1), the module is directed to do a gain calibration.
	Bit 05	**Calibration Clock bit (CK)** – When this bit is set to 1 (calibration mode), the calibration coefficient for the selected channels is accepted. When this bit is reset (0), the accepted calibration coefficients for the selected channels are stored, applied, and the calibration mode exited. Monitor status bits DN and BD for successful calibration.
	Bit 06	**Quick Calibration bit (QK)** – Normally reset (0). When this bit is set (1) during a calibration sequence, the calibration coefficient is stored to all related configurations for the selected channels. **NOTE:** Although this method of calibration quickly calibrates the selected channels, they will not be within the rated accuracy of the module.
	Bit 07	**Revert to Defaults bit (RV)** – Normally reset (0). When set (1) during a calibration procedure, default values for selected channels are used for the calibration coefficient. **NOTE:** They will not be within the rated accuracy of the module.
	Bits 08…11 (10…13)	**Request for Hold Outputs (Q)** – Channel request bits that instruct and output to hold its output level when EN transitions from 1 to 0 to 1. When EN is 0, outputs go to a save state dictated by S1/S0. When EN returns to 1, the outputs will hold their level until the output data equals the output level. P0...P3 indicates channels holding. Output read back data shows what level is being held. Q0 = bit 08 (10) = channel 0; Q1 = bit 08 (10) = channel 1, and so on.
	Bit 12 (14)	**Interleave Interrupt (IT)** – This bit, when set (1), permits interleaving of module interrupts ensuring exchange of critical data when channels are configured for their fastest update times. RTSI and "no low pass filter" must be 0 in order for the module to recognize this feature. This groups data update rates for all channels to the slowest configuration setting of any of the channels. In addition, channel update rates for all channels with a 7.5 ms update rate are reduced to 5.0 ms. When reset (0), real time sampling and filter features are enabled.
	Bit 13 (15)	**Transparent bit (TR)** – This bit, when set (1), permits configuration to be changed without using the IC bit.
	Biut 14 (16)	Set to 1.
	Bit 15 (17)	**Initiate Configuration bit (IC)** – When set (1), instructs this the module to enter configuration mode. Present configuration data prior to or coincident with IC being set. Once IC returns to 0, the configuration is applied and any subsequent configuration information is ignored until IC is toggled.
Write Words 7 and 8	Bits 00…15 (00…17)	Not used.

1794-IF2XOF2I Series B – Isolated Analog Combo Module Image Table Mapping



1794-IF2XOF2I – Isolated Analog Combo Module Read Words

Word/Dec. Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word/Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Read Word 0	Input Data Channel 0															
Read Word 1	Input Data Channel 1															
Read Word 2	Read Back Channel 0															
Read Word 3	Read Back Channel 1															
Read Word 4	0	Real Time Sample														
Read Word 5	PU	FP	CF	0	Reserved				0	0	0	0	0	BD	DN	0
Read Word 6	0	0	0	0	P1	P0	0	0	0	0	V1	V0	W1	W0	U1	U0
Write Word 0	EN	S1	S0	0	0	0	0	0	0	0	0	0	0	0	0	0
Write Word 1	Output Data – Channel 0															
Write Word 2	Output Data – Channel 1															
Write Word 3	0	0	0	0	0	0	0	0	Input Channel 1 Filter				Input Channel 0 Filter			
Write Word 4	Output Channel 1 Configuration				Output Channel 0 Configuration				Input Channel 1 Configuration				Input Channel 0 Configuration			
Write Word 5	0	Real Time Sample Programmed Interval														

1794-IF2XOF2I – Isolated Analog Combo Module Read Words

Word/Dec. Bit	**15**	**14**	**13**	**12**	**11**	**10**	**09**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Word/Octal Bit	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Write Word 6	IC	1	TR	IT	Q1	Q0	0	0	RV	QK	CK	GO	Channel Number			
Write Word 7	Not used															

Where:

PU = Power up unconfigured state
FP = Field power off
CF = Configuration mode
BD = Calibration bad
DN = Calibration accepted
P0 and P1 = Output holding in response to Q0...Q1
W0 and W3 =Wire off current loop status for channels 0 and 1 respectively. (Not used on voltage outputs).
U0 and U1 = Underrange for input channels 0 and 1 respectively
V0 and V1 = Overrange for input channels 0 and 1 respectively
EN = Enable outputs; 0 = output follows S1/S0, 1 = output enabled
IC = Initiate configuration bit
TR = Transparent bit
IT = Interrupt toggle bit
Q0 and Q1 = Hold
RV = Revert to defaults bit
QK = Quick calibration
CK = Calibration clock
GO = Gain offset select

Configure Your Input Channels

Input Channel Configuration				
03	02	01	00	Set these bits for Channel 0
07	06	05	04	Set these bits for Channel 1

Bit Settings				**Input Values**	**Data Format**	**% Underrange/ % Overrange**	**Input Range[2] Hexadec.**	**Dec.**	**Module Update Rate (RTSI = 0)**	**(RTSI = 0), IT = 1**
0	0	0	0	Channel not configured						
0	0	0	1	4...20 mA	signed 2's complement	4% Under; 4% Over	<0000...7878>	<0000...30840>	7.5 ms	5.0 ms
0	0	1	0	± 10V	signed 2's complement	2% Under; 2% Over	<831F...7CE1>	<-31969...31969>	2.5 ms	2.5 ms
0	0	1	1	± 5V	signed 2's complement	4% Under; 4% Over	<8618...79E8>	<-31208...31208>	2.5 ms	2.5 ms
0	1	0	0	0...20 mA	signed 2's complement %	0% Under; 4% Over	<0...2710>	<0...10000>	7.5 ms	5.0 ms
0	1	0	1	4...20 mA	signed 2's complement %	4% Under, 4% Over	<0...2710>	<0...10000>	7.5 ms	5.0 ms
0	1	1	0	0...10V	signed 2's complement %	0% Under; 2% Over	<0...2710>	<0...10000>	5.0 ms	5.0 ms
0	1	1	1	± 10V	singed 2's complement %	2% Under; 2% Over	<-D8F0...2710>	<-10000...10000>	5.0 ms	5.0 ms
1	0	0	0	0...20 mA	binary	0% Under; 4% Over	<0000...F3CF>	<0000...62415>	2.5 ms	2.5 ms
1	0	0	1	4...20 mA[1]	binary	4% Under; 4% Over	<0000...F0F1>	<0000...61681>	7.5 ms	5.0 ms
1	0	1	0	0...10V	binary	0% Under; 2% Over	<0000...F9C2>	<0000...63938>	2.5 ms	2.5 ms
1	0	1	1	0...5V	binary	0% Under; 4% Over	<0000...F3CF>	<0000...62415>	2.5 ms	2.5 ms
1	1	0	0	± 20 mA	offset binary, 8000H = 0 mA	4% Under; 4% Over	<0618...F9E8>	<1560...63976>	2.5 ms	2.5 ms
1	1	0	1	4...20 mA	offset binary, 8000H = 4 mA	4% Under; 4% Over	<8000...F878>	<32768...63608>	7.5 ms	5.0 ms
1	1	1	0	± 10V	offset binary, 8000H = 0V	2% Under, 2% Over	<031F...FCE1>	<799...64737>	2.5 ms	2.5 ms
				± 5V	offset binary, 8000H = 0V	4% Under, 4% Over	<0618...F9E8>	<1560...63976>	2.5 ms	2.5 ms

(1) Underrange for 4...20 mA occurs in the blind area below 0 (3.2 mA).

Setting the Input Filters

Bits				Channel	
03	02	01	00	Input Channel 0	
07	06	05	04	Input Channel 1	
				A/D Conversion Rate	**Low Pass Filter**
0	0	0	0	1200 Hz	No low pass
0	0	0	1	1200 Hz	100 ms low pass
0	0	1	0	1200 Hz	500 ms low pass
0	0	1	1	1200 Hz	1000 ms low pass
0	1	0	0	600 Hz	No low pass
0	1	0	1	600 Hz	100 ms low pass
0	1	1	0	600 Hz	500 ms low pass
0	1	1	1	600 Hz	1000 ms low pass
1	0	0	0	300 Hz	No low pass
1	0	1	0	300 Hz	100 ms low pass
1	0	1	1	300 Hz	500 ms low pass
1	1	0	0	300 Hz	1000 ms low pass
1	1	0	1	150 Hz	No low pass
1	1	1	0	150 Hz	100 ms low pass
1	1	1	1	150 Hz	500 ms low pass
				150 Hz	1000 ms low pass

(2) <and> indicates the overrun beyond actual range (about 5%).

Configure Your Output Channels

Configuration Bits MSD			LSD	Nominal Range	Data Type	Output Values Hexadecimal	Decimal	Update Rate
0	0	0	1	4...20 mA	2's complement	<0000...7878>	<0000...30840>	5.0 ms
0	0	1	0	± 10V	2's complement	<8618...79E8>	<-31208...31208>	2.5 ms
0	0	1	1	± 5V	2's complement	<8618...79E8>	<-31208...31208>	2.5 ms
0	1	0	0	0...20 mA	2's complement %	<0...10000>	<0...10000>	5.0 ms
0	1	0	1	4...20 mA	2's complement %	<0...10000>	<0...10000>	5.0 ms
0	1	1	0	0...10V	2's complement %	<0...10000>	<0...10000>	5.0 ms
0	1	1	1	± 10V	2's complement	<-10000...10000>	<-10000...10000>	5.0 ms
1	0	0	0	0...20 mA	binary	<0000...F3CF>	<0000...62415>	2.5 ms
1	0	0	1	4...20 mA	binary	<0000...F0F1>	<0000...61681>	5.0 ms
1	0	1	0	0...10V	binary	<0000...F3CF>	<0000...62415>	2.5 ms
1	0	1	1	0...5V	binary	<0000...F3CF>	<0000...62415>	2.5 ms
1	1	0	0	4...20 mA	offset binary	<8000...F9E8>	<32768...63976>	2.5 ms

Configure Your Output Channels

Configuration Bits MSD			LSD	Nominal Range	Data Type	Output Values Hexadecimal	Decimal	Update Rate
1	1	0	1	± 20 mA	offset binary	<8000...F878>	<32768...63608>	5.0 ms
1	1	1	0	± 10V	offset binary	<0618...F9E8>	<1560...63976>	2.5 ms
1	1	1	1	± 5V	offset binary	<0618...F9E8>	<1560...63976>	2.5 ms

1794-IF2XOF2I Analog Combo Module Word/Bit Descriptions

Word	Decimal Bit (Octal Bit)	Definition
Read Word 0	Bit 00…15 (00…17)	**Input Channel 0 input data** – 16-bit unipolar; 15-bit plus sign bipolar.
Read Word 1	Bit 00…15 (00…17)	**Input Channel 1 input data** – 16-bit unipolar; 15-bit plus sign bipolar.
Read Word 2	Bits 00…15 (00…17)	**Read Back Output Channel 0** – During normal operation, it is a copy of the output of channel 0. During an EN transition, it is the condition of the output as determined by S1 and S0.
Read Word 3	Bit 00…15 (00…17)	**Read Back Output Channel 0** – During normal operation, it is a copy of the output of channel 0. During an EN transition, it is the condition of the output as determined by S1 and S0.
Read Word 4	Bit 00…15 (00…17)	**Real Time Sample** – The fixed time period you set telling the module when to provide data to the processor.
Read Word 5	Bit 00	Reserved.
	Bit 01	**Calibration Done bit (DN)** – This bit is set to 1 after a calibration cycle is completed.
	Bit 02	**Calibration Bad bit (BD)** – This bit is set to 1 if the channel calibration coefficients cannot be saved or be read properly.
	Bits 03…07	Set to 0.
	Bits 08…11 (10…12)	Reserved.
	Bit 12 (14)	Set to 0.
	Bit 13 (15)	**Configuration mode bit (CF)** – This bit is set (1) when the calibration mode is selected (bit 15, word 5 in the block transfer write set to 1).
	Bit 14 (16)	**Field Power Off bit (FP)** – This bit is set (1) when the 24V field power fails. When this bit is set (1), the module status indicator flashes.
	Bit 15 (17)	**Power Up (unconfigured state) bit (PU)** – This bit is set (1) when the configuration word is all zeroes (0) due to a reset (adapter power cycle or module insertion) or a cleared configuration word (all 0).

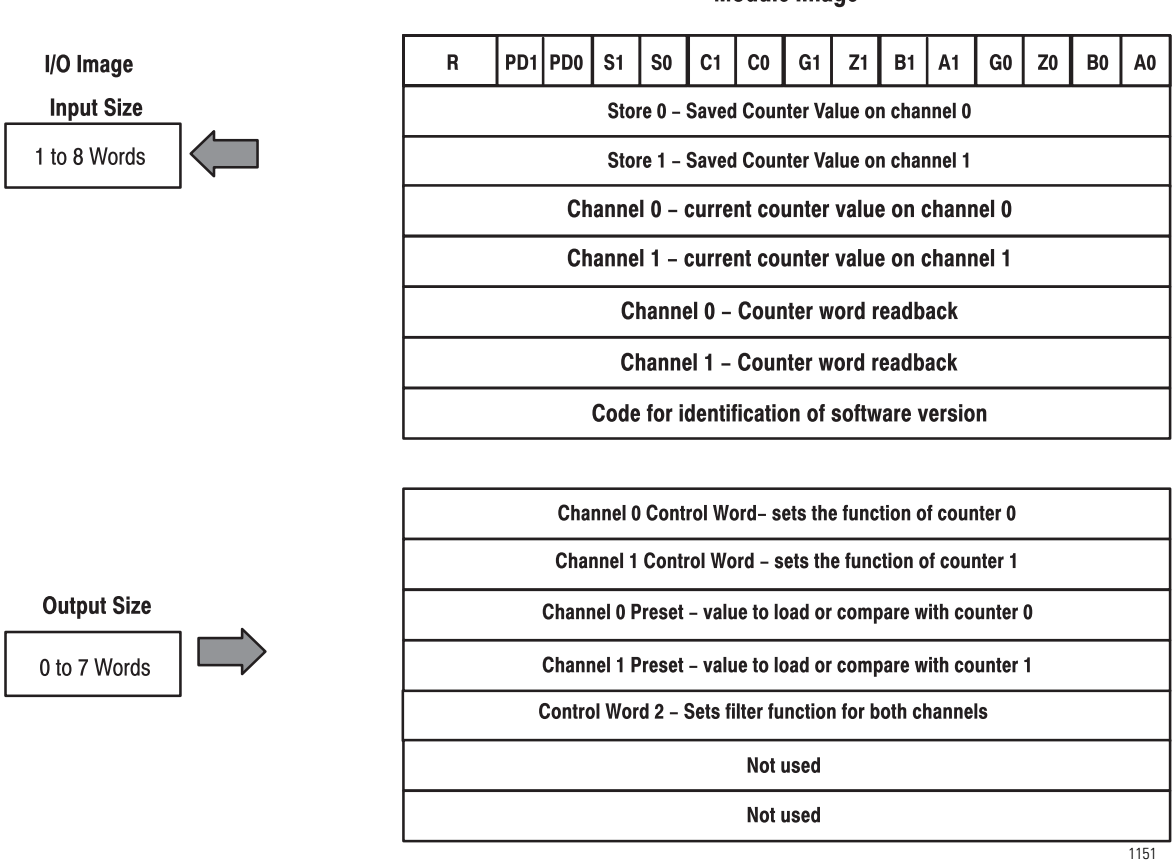
1794-IF2XOF2I Analog Combo Module Word/Bit Descriptions

Word	Decimal Bit (Octal Bit)	Definition
Read Word 6	Bits 00…01	**Underrange bits (U)** – These bits are set (1) when the input channel is below a preset limit as defined by the configuration selected. U0 (bit 00) corresponds to input channel 0 and U1 (bit 01) corresponds to input channel 1.
	Bits 02…03	**Wire-Off status bits (W)** – These bits, when set (1), indicate the corresponding current output channel is open. W0 (bit 02) corresponds to channel 0, W1 (bit 03) corresponds to channel 1.
	Bits 04…05	**Overrange bits** – These bits are set (1) when the input channel is above a preset limit as defined by the configuration selected. Bit 04 corresponds to input channel 0 and bit 05 corresponds to input channel 1.
	Bits 06…09 (06…11)	Not used. Set to 0.
	Bits 10…11 (12…13)	**Hold output bits (P)** – These bits are set (1) in response to Q0 or Q1 and a transition of the EN bit. When P0 or P1 is set (1), they indicate that the output is holding at the level in the readback data for the respective channel. These bits return to 0 when the output data matches the readback output data.
	Bits 12…15 (14…17)	Not used. Set to 0.
Write Word 0	Bits 00…12 (00…14)	Not used.
	Bit 13…14 (15…16)	**Safe State Configure bits (S1/S0)** – When EN is 0, these bits designate the source of the safe state data. Bit 13 = 0, bit 14 = 1 – reset outputs to 0V/0 mA Bit 13 = 1, bit 14 = 1 – hold the output at its current level
	Bit 15 (17)	**Output enable bit (EN)** – When set (1), the outputs are enabled. This bit must be set in order for the real time data to appear at the outputs. If this bit is not set (0), the outputs will be determined by S1/S0.
Write Word 1	Bits 00…15 (00…17)	Output Channel 0 data. See Configure Your Output Channels on page 55.
Write Word 2	Bits 00…15 (00…17)	Output Channel 1 data. See Configure Your Output Channels on page 55.
Write Word 3	**Input Channels 0 and 1 Filter Selections.** (See Setting the Input Filters on page 55).	
	Bits 00…01	**Channel 0 Filter Setting**
	Bits 04…07	**Channel 1 Filter Setting**
	Bits 8…15 (11…17)	Set to 0.
Write Word 4	**Channel Configuration**	
	Bits 00…03	**Input Channel 0 Configuration** – See Configuring Your Input Channel on page 45
	Bits 04…07	**Input Channel 1 Configuration** – See Configuring Your Input Channel on page 45
	Bits 08…11 (10…13)	**Output Channel 0 Configuration** – See Configuring Your Input Channel on page 45.
	Bits 12…15 (14…17)	**Output Channel 1 Configuration** – See Configuring Your Input Channel on page 45.
Write Word 5	Bits 00…14 (00…16)	**Real Time Sample Interval** – Programs the interval of the real time sample. Can be varied from 0...30 s (30000 decimal). Resolution is in ms with granularity in 5 ms steps.
	Bit 15 (17)	Set to 0.

1794-IF2XOF2I Analog Combo Module Word/Bit Descriptions

Word	Decimal Bit (Octal Bit)	Definition
Write Word 6	Bit 00…03	**Channel Calibration Selection bit** – When this bit is set (1), the channel can be claibrated using the initiate calibration bit (IC). Bit 00 corresponds to input channel 0, bit 01 corresponds to input channel 1, bit 02 corresponds to output channel 0, bit 03 corresponds to output channel 1.
	Bit 04	**Gain/Offset Calibration bit (GO)** – When this bit is set (1), a reset (0), set (1), reset (0) pattern of the calibration clock bit (CK) causes a **gain** calibration to occur. When this bit is set to 0, a reset (0), set (1), reset (0) pattern of the calibration clock bit (CK) causes and **offset** calibration to occur.
	Bit 05	**Calibration clock bit (CK)** – When this bit is set to 1 (calibration mode), the calibration coefficient for the selected channels is accepted. When this bit is reset (0), the accepted calibration coefficients are stored in the selected channels, applied, and the calibration mode exited. Monitor status bits DN and BD for succesful calibration.
	Bit 06	**Quick Calibration bit (QK)** – Normally reset (0). When this bit is set (1) during a calibration sequence, the calibration coefficient is stored to all related configurations for the selected channels. **NOTE:** This method of calibration quickly calibrates the selected channels, you will not be within the rated accuracy of the module.
	Bit 07	**Revert to defaults bit (RV)** – Normally reset (0). When set (1) during a calibration procedure, default values for selected channels are used for the calibration coefficient.
	Bits 08…09 (10…11)	Not used. Set to 0.
	Bits 10…11 (12…13)	**Request for hold outputs (Q)** – Channel request bits that instruct an output to hold its output level when EN transitions from 0 to 1 to 0. When EN is 0, outputs go to a safe state dictated by S1/S0. When EN returns to 1, the outputs will hold their level until the output data equals the output level. P0...P3 indicates channels holding. Output read back data shows what level is being held. Q0 = bit 08 (10) = channel 0; Q1 = bit 08 (10) = channel 1, and so on.
	Bit 12 (14)	**Interleave Interrupts (IT)** – This bit, when set (1), permits interleaving of module interrupts ensuring exchange of critical data when channels are configured for their fastest update times. RTSI and "no low pass filter" must be 0 in order for the module to recognize this feature. This groups data update rates for all channels to the slowest configuration setting of any of the channels. In addition, channel update rates for all channels with a 7.5 ms update rate are reduced to 5.0 ms. When reset (0), real time sampling and filter features are enabled.
	Bit 13 (15)	**Transparent bit (TR)** – This bit, when set (1), permits configuration to be changed without using the IC bit.
	Bit 14 (16)	Set to 1.
	Bit 15 (17)	**Initiate Configuration bit (IC)** – When set (1), instructs the module to enter configuration mode. Present confirugation data prior to or coincident with IC being set. Once IC returns to 0, additional configuration information is ignored.
Write Word 7	Bits 00…15 (00…17)	Not used.

1794-ID2 – Incremental Encoder Module Image Table Mapping


Module Image
I/O Image
Input Size
1 to 8 Words
R
PD1
PD0
S1
S0
C1
C0
G1
Z1
B1
A1
G0
Z0
B0
A0
Store 0 – Saved Counter Value on channel 0
Store 1 – Saved Counter Value on channel 1
Channel 0 – current counter value on channel 0
Channel 1 – current counter value on channel 1
Channel 0 – Counter word readback
Channel 1 – Counter word readback
Code for identification of software version
Output Size
0 to 7 Words
Channel 0 Control Word– sets the function of counter 0
Channel 1 Control Word – sets the function of counter 1
Channel 0 Preset – value to load or compare with counter 0
Channel 1 Preset – value to load or compare with counter 1
Control Word 2 – Sets filter function for both channels
Not used
Not used
1151

1794-ID2 Pulse Counter Module Word/Bit Definitions for Block Transfer Read Words

Word	Bit	Definition
Read Word 0	Bit 00	**Ch 0 Input A** – (pulse transmitter 0) – This bit, when set, indicates a signal at A.
	Bit 01	**Ch 0 Input B** – (pulse transmitter 0) – This bit, when set, indicates a signal at B.
	Bit 02	**Ch 0 Input Z** – (pulse transmitter 0) – This bit, when set, indicates a signal at Z.
	Bit 03	**Ch 0 Input G** – (pulse transmitter 0) – This bit, when set, indicates a signal at G.
	Bit 04	**Ch 1 Input A** – (pulse transmitter 1) – This bit, when set, indicates a signal at A.
	Bit 05	**Ch 1 Input B** – (pulse transmitter 1) – This bit, when set, indicates a signal at B.
	Bit 06	**Ch 1 Input Z** – (pulse transmitter 1) – This bit, when set, indicates a signal at Z.
	Bit 07	**Ch 1 Input G** – (pulse transmitter 1) – This bit, when set, indicates a signal at G.
	Bit 08 (10)	**Calibrated 0** – This bit, when set (1), indicates that the counter 0 has been calibrated. This bit is reset by CalReset.
	Bit 09 (11)	**Calibrated 1** – This bit, when set (1), indicates that the counter 1 has been calibrated. This bit is reset by CalReset.
	Bit 10 (12)	**Ch 0 Counter Stored** – This bit, when set (1), indicates a counter value is saved in store 0. This bit is reset by StoreReset.

1794-ID2 Pulse Counter Module Word/Bit Definitions for Block Transfer Read Words

Word	Bit	Definition
Read Word 0	Bit 11 (13)	**Ch 1 Counter Stored** – This bit, when set (1), indicates a counter value is saved in store 1. This bit is reset by StoreReset.
	Bit 12 (14)	**Ch 0 Preset Reached (PR0)** – When this bit is set (1), in all configuration modes, the counter 0 value equals the preset 0 value, either in a positive or negative direction. This bit is reset by PresetReset0 and can only be set again after at least 1 more pulse.
	Bit 13 (15)	**Ch 1 Preset Reached (PR1)** – When this bit is set (1), in all configuration modes, the counter 1 value equals the preset 0 value, either in a positive or negative direction. This bit is reset by PresetReset1 and can only be set again after at least 1 more pulse.
	Bit 14 (16)	**Ch 0 Counter Inc/Dec** – 0 = last pulse decreased counter value, 1 = last pulse increased counter value
	Bit 15 (17)	**Ch 1 Counter In/Dec** – 0 = last pulse decreased counter value, 1 = last pulse increased counter value
Read Word 1	Bits 00…15 (00…17)	**Ch 0 Stored Counter** – Saved counter value on channel 0.
Read Word 2	Bits 00…15 (00…17)	**Ch 1 Stored Counter** – Saved counter value on channel 1.
Read Word 3	Bits 00…15 (00…17)	**Ch 0 Counter** – Current value in counter 0.
Read Word 4	Bits 00…15 (00…17)	**Ch 1 Counter** – Current value in counter 1.
Read Word 5	Bits 00…15 (00…17)	**Ch 0 Counter Readback** – Counter word readback – last value written to write word 1.
Read Word 7	Bits 00…15 (00…17)	**Ch 1 Counter Readback** – Counter word readback – last value written to write word 2.
Read Word 8	Bits 00…15 (00…17)	**Firmware Revision** – identification of latest software version code.

1794-ID2 Pulse Counter Module Word/Bit Definitions for Block Transfer Read Words

Word	Bit	Definition			
Write Word 0	0…15 (0…17)	Ch 0 Control – Control word for setting the function of Ch 0 Counter.			
	Bits 00…02	**02**	**01**	**00**	**Ch 0 Mode Selection bits**
		0	0	0	Counting on positive (rising) edge of input signal A (Up/dwn counting determined by B).
		0	0	1	Quadrature encoder X1.
		0	1	0	Quadrature encoder X2.
		0	1	1	Quadrature encoder X4.
		1	0	0	Counting up on positive edge of input signal A, and down on positive edge of input signal B.
		1	0	1	No count function.
		1	1	0	No count function.
		1	1	1	No count function.
	Bit 03	**Ch 0 Counter Preset bit** – A positive edge on this bit moves the value in Preset X to Counter X, independent of Preset Enable. **NOTE:** To use Preset as Reset, use a count value of 0000 in the Preset value word.			

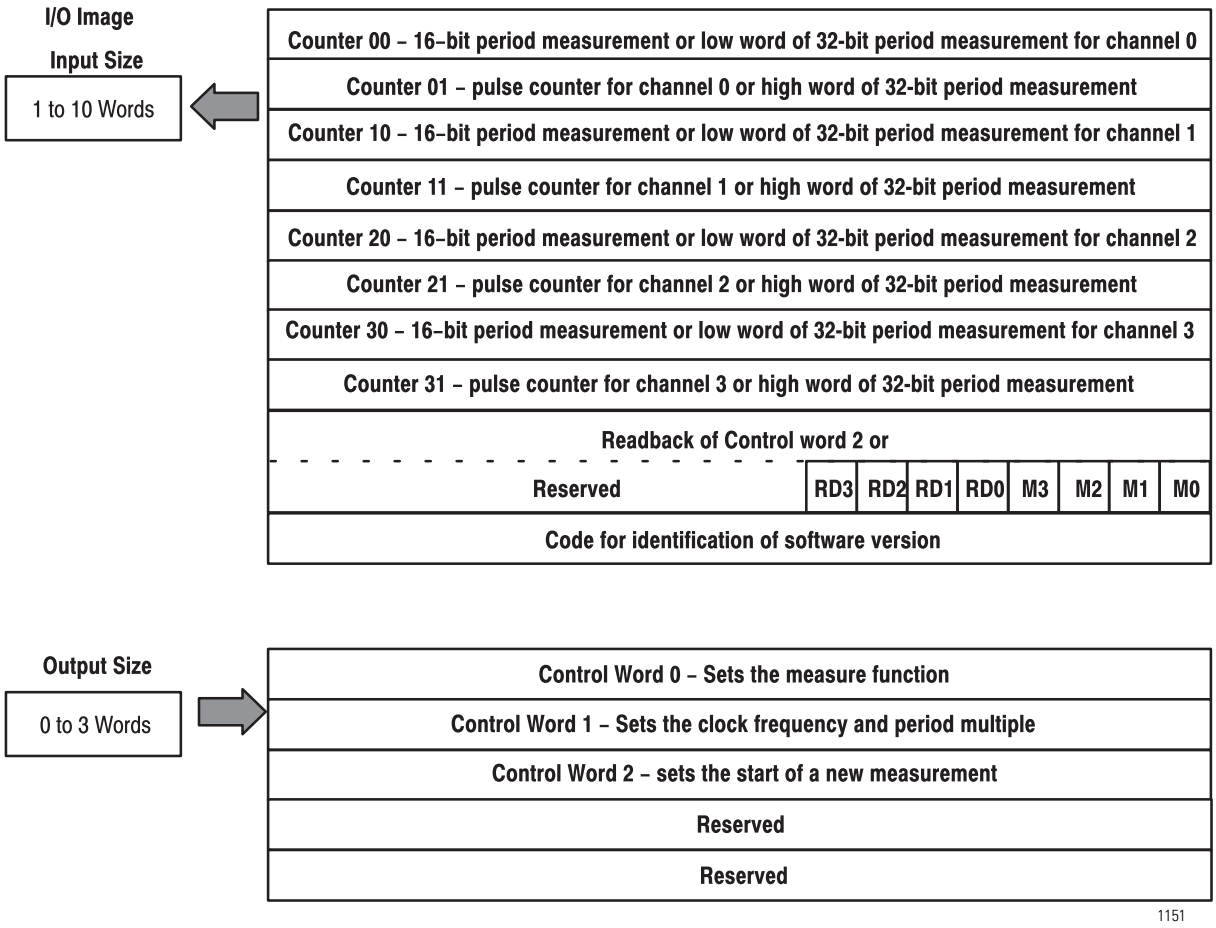
1794-ID2 Pulse Counter Module Word/Bit Definitions for Block Transfer Read Words

Word	Bit	Definition				
Write Word 1	Bit 04	**Ch 0 Z Preset Enable bit** – When this bit is set (1), a positive edge on Z preloads Counter X = Preset X, independent of Cal Enable. **NOTE:** If Z is configured to do Store and Preset (Reset), the Store will occur first.				
	Bit 05	**Ch 0 Count Enable bit** – When this is set (1), the incremental encoder is enabled.				
	Bits 06…08 (06…10)	**Ch 0 Calibration Control bits** – bits 06, 07 and 08.				
		06	**Cal Enable bit** – When set (1), the counter can be calibrated.			
		07	**Cal Direction bit** – When set (1), calibration is performed in a negative direction; when reset (0), calibration is performed in a positive direction.			
		08	**Ch 0 Cal Reset bit** – Calibration is acknowledged and a new calibration is enabled on a positive edge on this bit.			
	Bits 09…10 (11…12)	10	09	**Gate Control bits**		
		0	0	No gate function on input G.		
		0	1	Counting only if G is high (active).		
		1	0	Counting only if G is low (inactive).		
		1	1	The counter can be calibrated when G is high (active).		
	Bits 11…12 (13…14)	12	11	**Store Control bits**		
				Save the counter value on positive edge of Z (if Stored X = 0).		
				Save the counter value on positive edge of G (if Stored X = 0).		
				Save the counter value on negative edge of G (if Stored X = 0).		
				Save the counter value on positive and negative edges of G (if Stored X = 0).		
	Bit 13 (15)	**Ch 0 Rollover bit** – When set (1), the counter counts up to the prset and then restarts at 0. If this bit is reset (0) (not rollover), the rollover preset value = FFFF (hex = 65536 (decimal).				
	Bit 14 (16)	**Ch 0 Store Reset bit** – A positive edge on this bit resets Stored X in Signals.				
	Bit 15 (17)	**Ch 0 Preset Reset bit** – A positive edge on this bit resets Preset Detected in Signals.				
Write Word 2		**Ch 1 Control** – Control word for setting the fuction of Ch 1 Counter.				
	Bits 00…02	Bit	02	01	00	**Ch 1 Mode Selection bits**
			0	0	0	Counting on positive (rising) edge of input signal A (up/dwn counting determined by B).
			0	0	1	Quadrature encoder X1.
			0	1	0	Quadrature encoder X2.
			0	1	1	Quadrature encoder X4.
			1	0	0	Counting up on the positive edge of input signal A, and down on positive edge of input signal B.
			1	0	1	No count function.
			1	1	0	No count function.
			1	1	1	No count function.

1794-ID2 Pulse Counter Module Word/Bit Definitions for Block Transfer Read Words

Word	Bit	Definition		
Write Word 2	Bit 03	**Counter Preset bit** – A positive edge on this bit moves the value in Preset X to Counter X, independent of Preset Enable.		
	Bit 04	**Preset Enable bit** – When set (1), a positive edge on Z preloads Counter X = Preset X, independent of Cal Enable.		
	Bit 05	**Count Enable bit** – When set (1), the incremental encoder is counting.		
	Bits 06…08 (06…10)	**Calibration Control bits** – bits 06, 07 and 08.		
		06	**Enable bit** – When set (1), the counter can be calibrated.	
		07	**Direction bit** – When set (1), calibration is performed in a negative direction; when reset (0), calibration is performed in a positive direction.	
		08	**Reset bit** – Calibration is acknowledged and a new calibration is enabled on a positive edge on this bit.	
	Bits 09…10 (11…12)	10	09	**Gate Control bits**
		0	0	No gate function on input G.
		0	1	Counting only if G is high (active).
		1	0	Counting only if G is low (inactive).
		1	1	Calibration if G is high (active).
	Bits 11…12 (13…14)	12	11	**Latch Control bits**
		0	0	Save the counter value on the positive edge of Z (if Stored X = 0).
		0	1	Save the counter value on the positive edge of G (if Stored X = 0).
		1	0	Save the counter value on the negative edge of G (if Stored X = 0).
		1	1	Save the counter value on the positive and negative edges of G (if Stored X = 0).
	Bit 13 (15)	**Rollover bit** – When set (1), the counter counts up to the preset and then restarts at 0. If this bit is reset (0) (not rollover), the rollover preset value = FFFF hex = 65535 (decimal).		
	Bit 14 (16)	**Ch 1 Preset Reset bit** – A positive edge on this bit resets Stored X in Signals.		
	Bit 15 (17)	**Ch 1 Store Reset bit** - A positive ege on this bit resets Preset Reached in Signals.		
Write Word 3	Bits 00…15 (00…17)	**Ch 0 Preset** – Value to load or compare with counter 0.		
Write Word 4	Bits 00…15 (00…17)	**Ch 1 Preset** – Value to load or compare with counter 1.		
Write Word 5	**Filter Selection**			
	Bit 00	**Ch 0 Filter Enable** – When set (1), and a counter 0 is in mode 000 (pulse counting), signal A0 is filtered by a digital low pass filter with selectable filter constant.		
	Bit 01	**Ch 1 Filter Enable** – When set (1), and a counter 1 is in mode 000 (pulse counting), signal A1 is filtered by a digial low pass filter with selectable filter constant.		
	Bit 02…07	Unused.		
	Bits 08…09 (10…11)	09 (11)	08 (10)	**Filter bits** – This constand is common to both counters.
		0	0	73.5 kHz or minimum 0.007 ms pulsewidth.
		0	1	37.8 kHz or minimum 0.013 ms pulsewidth.
		1	0	12.8 kHz or minimum 0.04 ms pulsewidth.
		1	1	1.2 kHz or minimum 0.4 ms pulsewidth.
Write Words 6…7	Bits 00…15 (00…17)	Not used – set to 0.		

1794-IP4 – Pulse Counter Module Image Table Mapping


I/O Image
Input Size
1 to 10 Words
Counter 00 – 16–bit period measurement or low word of 32-bit period measurement for channel 0
Counter 01 – pulse counter for channel 0 or high word of 32-bit period measurement
Counter 10 – 16–bit period measurement or low word of 32-bit period measurement for channel 1
Counter 11 – pulse counter for channel 1 or high word of 32-bit period measurement
Counter 20 – 16–bit period measurement or low word of 32-bit period measurement for channel 2
Counter 21 – pulse counter for channel 2 or high word of 32-bit period measurement
Counter 30 – 16–bit period measurement or low word of 32-bit period measurement for channel 3
Counter 31 – pulse counter for channel 3 or high word of 32-bit period measurement
Readback of Control word 2 or
Reserved
RD3 RD2 RD1 RD0 M3 M2 M1 M0
Code for identification of software version
Output Size
0 to 3 Words
Control Word 0 – Sets the measure function
Control Word 1 – Sets the clock frequency and period multiple
Control Word 2 – sets the start of a new measurement
Reserved
Reserved
1151

1794-IP4 Pulse Counter Module Block Transfer Word Assignments

(Octal Bit ⇒)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Dec. Bit ⇒	**15**	**14**	**13**	**12**	**11**	**10**	**03**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Word ⇓	**Read**															
1	Ch 0 Data 0 – 16-bit period measurement or low word of 32-bit period measurement for channel 0.															
2	Ch 0 Data 1 – pulse counter or high word of 32-bit period measurement for channel 0.															
3	Ch 1 Data 0 – 16-bit period measurement or low word of 32-bit period measurement for channel 1.															
4	Ch 1 Data 1 – pulse counter or high word of 32-bit period measurement for channel 1.															
5	Ch 2 Data 0 – 16-bit period measurement or low word of 32-bit period measurement for channel 2.															
6	Ch 2 Data 1 – pulse counter or high word of 32-bit period measurement for channel 2.															
7	Ch 3 Data 0 – 16-bit period measurement or low word of 32-bit period measurement for channel 3.															
8	Ch 3 Data 1 – pulse counter or high word of 32-bit period measurement for channel 3.															
9	Status.															
	Reserved.								RD3	RD2	RD1	RD0	Ch 3 Ready	Ch 2 Ready	Ch 1 Ready	Ch 0 Ready
10	Revision read – software version code.															

1794-IP4 Pulse Counter Module Block Transfer Word Assignments

(Octal Bit ⇒)	17	16	15	14	13	12	11	10	07	06	05	04	03	02	01	00
Dec. Bit ⇒	**15**	**14**	**13**	**12**	**11**	**10**	**03**	**08**	**07**	**06**	**05**	**04**	**03**	**02**	**01**	**00**
Word ⇓	**Write**															
1	Control Word 0 – selects the measure function.															
2	Control Word 1 – sets the clock frequency and period multiple.															
3	Control Word 2 – sets the start of a new measurement.															
4…5	Reserved.															
Where:	M = Positive edge measurement ready for the respective channel. RD = Reset Done for respective channel.															

1794-IP4 Pulse Counter Module Word/Bit Definitions

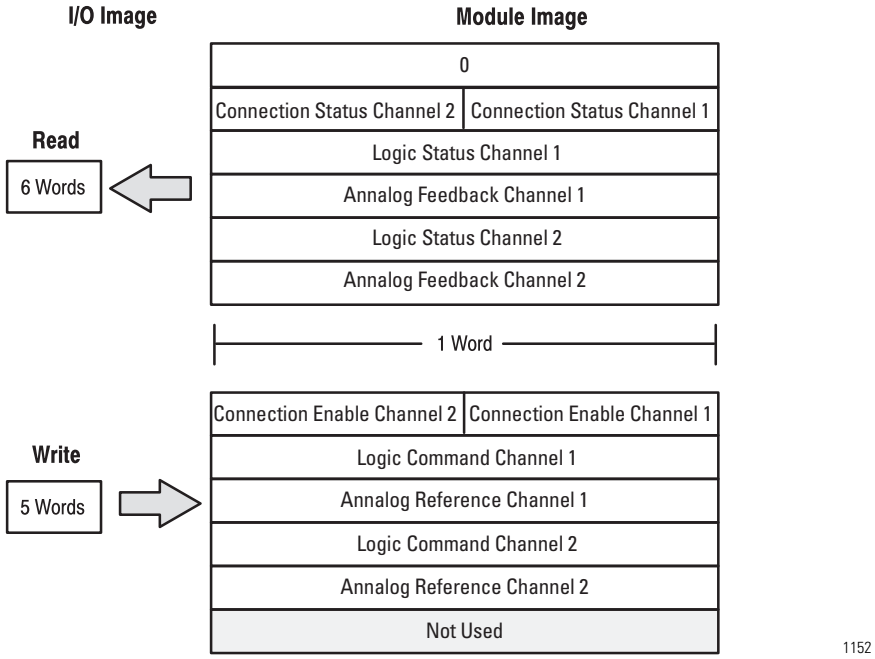
Word	Bit	Definition
Read Word 0	Bit 00…15 (00…17)	**Store Counter 00** – 16-bit period measurement or low word of 32-bit period measurement for channel 0.
Read Word 1	Bit 00…15 (00…17)	**Ch 0 Data 0** – pulse counter or high word of 32-bit period measurement for channel 0.
Read Word 2	Bit 00…15 (00…17)	**Ch 0 Data 1** – 16-bit period measurement or low word of 32-bit period measurement for channel 1.
Read Word 3	Bit 00…15 (00…17)	**Ch 1 Data 1** – pulse counter or high word of 32-bit period measurement for channel 1.
Read Word 4	Bit 00…15 (00…17)	**Ch 2 Data 0** – 16-bit period measurement or low word of 32-bit period measurement for channel 2.
Read Word 5	Bit 00…15 (00…17)	**Ch 2 Data 1** – pulse counter or high word of 32-bit period measurement for channel 2.
Read Word 6	Bit 00…15 (00…17)	**Ch 3 Data 0** – 16-bit period measurement or low word of 32-bit period measurement for channel 3.
Read Word 7	Bit 00…15 (00…17)	**Ch 3 Data 1** – pulse counter or high word of 32-bit period measurement for channel 3.
Read Word 8	**Bit**	**Status**
	Bit 00	**Ch 0 Ready** – measurement ready.
	Bit 01	**Ch 1 Ready** – measurement ready.
	Bit 02	**Ch 2 Ready** – measurement ready.
	Bit 03	**Ch 3 Ready** – measurement ready.
	Bit 04	**Reset Done, Ch 0** – positive edge on this bit indicates counter 01 reset done.
	Bit 05	**Reset Done, Ch 1** – positive edge on this bit indicates counter 11 reset done.
	Bit 06	**Reset Done, Ch 2** – positive edge on this bit indicates counter 21 reset done.
	Bit 07	**Reset Done, Ch 3** – positive edge on this bit indicates counter 31 reset done.
	Bit 08…15	Reserved for factory use.
Read Word 9	Bits 00…15 (00…17)	**Software revision** – Version code of software installed.

1794-IP4 Pulse Counter Module Word/Bit Definitions

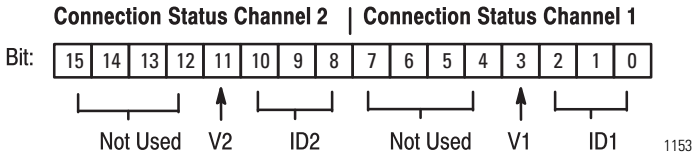
Word	Bit	Definition			
Write Word 0	**Bit**	**Control Word 0** – Control word for setting the function of counter 0.			
	Bit 00	**Pulse counting and period time measurement selection for Channel 0** – 0 = pulse counting and period measurement selected. 1 = period time measurement selected.			
	Bit 01	**Pulse counting and period time measurement selection for Channel 1** – 0 = pulse counting and period measurement selected. 1 = period time measurement selected.			
	Bit 02	**Pulse counting and period time measurement selection for Channel 2** – 0 = pulse counting and period measurement selected. 1 = period time measurement selected.			
	Bit 03	**Pulse counting and period time measurement selection for Channel 3** – 0 = pulse counting and period measurement selected. 1 = period time measurement selected.			
	Bits 04…15 (04…17)	Reserved.			
Write Word 1	Bit 00	**Clock frequency for period time measurement - Channel 0 –** 0 = period time measurement with 10 MHz internal clock selected. 1 = period time measurement with 1 MHz internal clock selected.			
	Bits 01…03	03	02	01	Number of periods for measurement - Channel 0.
		0	0	0	1 period.
		0	0	1	2 periods.
		0	1	0	4 periods.
		0	1	1	8 periods.
		1	0	0	16 periods.
		1	0	1	32 periods.
		1	1	0	64 periods.
		1	1	1	128 periods.
	Bit 04	**Clock frequency for period time measurement - Channel 1** – see Bit 00 above.			
	Bits 05…07	Selection of Number of period for measurement - Channel 1 – see Bits 01…03 above.			
	Bits 08(10)	**Clock frequency for period time measurement - Channel 2** – see Bit 00 above.			
	Bits 09…11 (11…13)	Selection of Number of period for measurement - Channel 2 – see Bits 01…03 above.			
	Bit 12(14)	**Clock frequency for period time measurement - Channel 1** – see Bit 00 above.			
	Bits 13…15 (15…17)	Selection of Number of periods for measurement - Channel 1 – see Bits 01…03 above.			

Write Word 2	Bit 00	**Start new measurment bit - Channel 0** – when set, start new measurement on positive edge.
	Bit 01	**Start new measurment bit - Channel 1** – when set, start new measurement on positive edge.
	Bit 02	**Start new measurment bit - Channel 2** – when set, start new measurement on positive edge.
	Bit 03	**Start new measurment bit - Channel 3** – when set, start new measurement on positive edge.
	Bit 04	**Reset Counter, Channel 0** – positive edge on this bit resets counter 01.
	Bit 05	**Reset Counter, Channel 1** – positive edge on this bit resets counter 11.
	Bit 06	**Reset Counter, Channel 2** – positive edge on this bit resets counter 21.
	Bit 07	**Reset Counter, Channel 3** – positive edge on this bit resets counter 31.
	Bits 08…15 (10…17)	Reserved.
Write Words 3 and 4	Bit 00…15 (00…17)	Reserved.

1203-FM1 – SCANport Module Image Table Mapping



Connection Status Word Definition



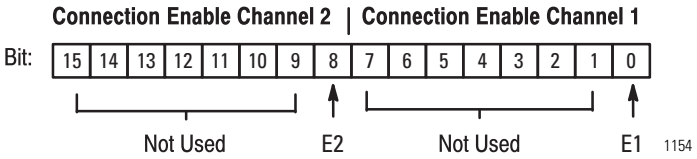
Connection Status Word Definitions

	Descripton
V1	SCANport channel 1 valid data bit. When high (1), the Logic Status and Analog Feedback values are valid and can be used. When low (0), the values should not be used.
ID1	SCANport channel 1 connected peripheral port ID number. This three bit field contains the port number that channel 1 is connected to on the SCANport device. It should contain a value between 1 and 7. If this field is 7, then the channel is not connected to the SCANport device or the SCANport device may not be powered.
V2	SCANport channel 2 valid data bit. When high (1), the Logic Status and Analog Feedback values are valid and can be used. When low (0), the values should not be used.
ID2	SCANport channel 2 connected peripheral port ID number. This three bit field contains the port number that channel 2 is connected to on the SCANport device. It should contain a value between 1 and 7. If this field is 7, then the channel is not connected to the SCANport device, or the SCANport device may not be powered.

Logic Status/Analog Feedback Definition

The Logic State and Analog Feeback values are defined within the product manuals of the connected SCANport device(s).

Connection Enable Word Definition



Connection Enabled Word Definitions

	Descripton
E1	SCANport channel 1 enable bit. When set (1), the module attempts to connect to the SCANport device. When reset (0), the module stops communicating with the connected SCANport device. This usually causes the device to fault.
E2	SCANport channel 2 enable bit. When set (1), the module attempts to connect to the SCANport device. When reset (0), the module stops communicating with the connected SCANport device. This usually causes the device to fault.

Logic Command/Analog Reference Definition

The Logic Command and Analog reference values are defined within the product manuals of the connected SCANport device(s).

Defaults

Each I/O module has default values associated with it. At default, each module generates inputs/status and expects outputs/configuration.

FLEX I/O Module Defaults

Module Defaults for:		Adapter Defaults		Optimal Sizes	
Catalog Number	Description	Input Default	Output Default	Input Default	Output Default
1794-IB8	8-pt 24V DC Sink Input	1	1	1	0
1794-OB8	8-pt 24V DC Source Output	1	1	0	1
1794-IB16	16-pt 24V DC Sink Input	1	1	1	0
1794-OB16	16-pt 24V DC Source Output	1	1	0	1
1794-IV16	16-pt 24V DC Source Input	1	1	1	0
1794-OV16	16-pt 24V Sink Output	1	1	0	1
1794-OB8EP	Elec. Prot. Output Module	1	1	0	1
1794-IB10XOB6	10 In/6 Out Combo Module	1	1	1	1
1794-IA8	8-pt 120V AC Input	1	1	1	0
1794-OA8	8-pt 120V AC Output	1	1	0	1
1794-IB8S	8-pt 24V DC Sensor Input	1	1	1	0
1794-OW8	8-pt Relay Output	1	1	0	1
1794-IE8	8-pt Analog Input	9	6	8	0
1794-OE4	4-pt Analog Output	1	14	0	4
1794-IE4XOE2	4 in/2 out Analog Combo	5	10	4	2
1794-IR8	8-pt RTD Analog Input	11	4	10	0
1794-IT8	8-pt Thermocouple Input	11	4	10	0
1794-IRT8	TC/mV/TRD Module	11	4	1	0
1794-IF4I	4 Isolated Input Module	7	5	1	0
1794-OF4I	4 Isolated Output Module	6	9	0	1
1794-IF2XOF2I	Isolated Combo Module	7	7	1	1
1794-ID2	Incremental Encoder Module	8	7	1	0
1794-IP4	Pulse Counter Module	10	3	1	0
1203-FM1	SCANport Module	6	5	4	3

The default values refect the maximum number of read/write words.

You can change the I/O data size for a module by reducing the number of words mapped into the adapter module, as shown in optimal sizes.

Optimal sizes are the settings that provide optimal data to and from the I/O modules. You need a software configuration tool to change the size. Make sure the FLEX I/O adapter is compatible with the configuration tool you choose.

The optimal setting provide the fastest network time by only mapping read and write words used by the I/O modules. If you reduce your data sizes to only include optimal data, you can only change your configuration data with a software tool. If you need to change configuration information on an optimal basis, your data size must be large enough to include the necessary words.

Chapter Summary

In this chapter you learned how to communicate with your module. Read the next chapter to learn how to connect to the PROFIBUS DP network.

Notes:

Connect Your Adapter to the PROFIBUS DP Network

Overview

Read this chapter to install the input and output analog modules.

For Information On	Page
The DP Physical Layer	71
Cabling and Equipment Required for Line A Type	72
Cabling and Equipment Required for Line B Type	73
Connect the Adapter to the Network	74
Terminate the Network	76

The DP Physical Layer

The PROFIBUS network media is a balanced transmission line corresponding to the standard EIA RS-485, terminated at both ends. Both line A and line B types are available, depending on your system requirements.

Specifications and guidelines for DP media:

- linear bus, terminated at both ends
- drop cables (preferably no longer than .30 m), no branches
- shielded twisted pair
- max. line length between 100 and 1200 m (depending on baudrate and cable type)
- number of stations: 32
- DP baudrates: 9.6, 19.2, 93.75, 187.5, 500 Kbit/s, 1.5 Mbit/s, 12 MBd

Use the following table to determine what line type will best meet your needs.

Line Type Characteristics

Characteristic	Bus Segments and Drop Cables[1]		
	Line A Requirements[2]	Line B Requirements	Total Capacity of all Drop Cables
Impedance	**135…165 Ω (3-29 MHz)**	**100…130 Ω (f> 100 kHz)**	
Capacity	< 30 pF/m	< 60 pF/m	
Resistance	< 110 Ω/km	–	
Wire Gauge	> 0.64 mm	> 0.53 mm	
Conductor Area	> 0.34 mm	> 0.22 mm	

Line Type Characteristics

Characteristic		Bus Segments and Drop Cables[1]		
		Line A Requirements[2]	Line B Requirements	Total Capacity of all Drop Cables
Impedance		**135…165 Ω (3-29 MHz)**	**100…130 Ω (f> 100 kHz)**	
Maximum Length with Baud Rate (bits/s) of:	≤ 19.2 k	1200 m	1200 m	≤ 15 nF
	93.75 k	1200 m	1200 m	≤ 3 nF
	187.5 k	1000 m	600 m	≤ 1 nF
	500 k	400 m	200 m	≤ 0.6 nF
	1.5 M	200 m	NA	≤ 0.2 nF
	12 M	100 m		
Where:	NA = Not Applicable			

(1) Measurements are the sum of all bus segments and drop cable lengths combined.

(2) If using a combination of both line types, divide the lengths shown by two.

Cabling and Equipment Required for Line A Type

Line A cabling can support baudrates as high as 1.5 Mbits/s.

Cables

You need a shielded twisted pair cable for your cabling (bus segments or drop cables). Any line A cable available on the market can be used to connect your adapter to a PROFIBUS network.

T-junction Connectors

You need t-junction connectors to connect your droplines to bus segments. You can use any t-junctions available on the market.

Termination Blocks

Termination blocks are only needed if the devices on the end of the network do not have built-in terminating resistors. If you need termination blocks, you can use any termination blocks available on the market.

Bus Connector

Connect your adapter to the PROFIBUS DP network by attaching a bus connector to the female 9 pin D-Sub connector on the front of the module.

IMPORTANT For detailed information on the topology and cabling for line A, refer to the PROFIBUS Standard (DIN 19245 Parts 1 & 3, Issue 1994).

Cabling and Equipment Required for Line B Type

Line B cabling can support baudrates as high as 500 kbits/s.

Cables

You need a shielded twisted pair cable for your cabling (bus segments or drop cables). Any shielded twisted pair cables available on the market can be used to connect your adapter to a PROFIBUS network, however, bus segment cables must contain wire for data ground and a cable braid shield. We recommend Sprecher+Schuh cable as shown in the table below.

T-junction Connectors

You need T-junction connectors to connect your droplines to bus segments. You can use any t-junctions available on the market, however, we recommend Sprecher+Schuh connectors as shown in Table Cable Types and Descriptions on page 74.

Termination Blocks

Termination blocks are only needed if the devices on the end of the network do not have built-in terminating resistors. If you need to use termination blocks, any termination blocks available on the market can be used, however, we recommend Sprecher+Schuh termination blocks as shown in the table below.

Bus Connector

Connect your adapter to the PROFIBUS DP network by attaching a bus connector to the female 9 pin D-Sub connector on the front of the module.

IMPORTANT For detailed information on the topology and cabling for line B, refer to the PROFIBUS Standard (DIN 19245 Parts 1 & 3, Issue 1994).

Cable Types and Descriptions

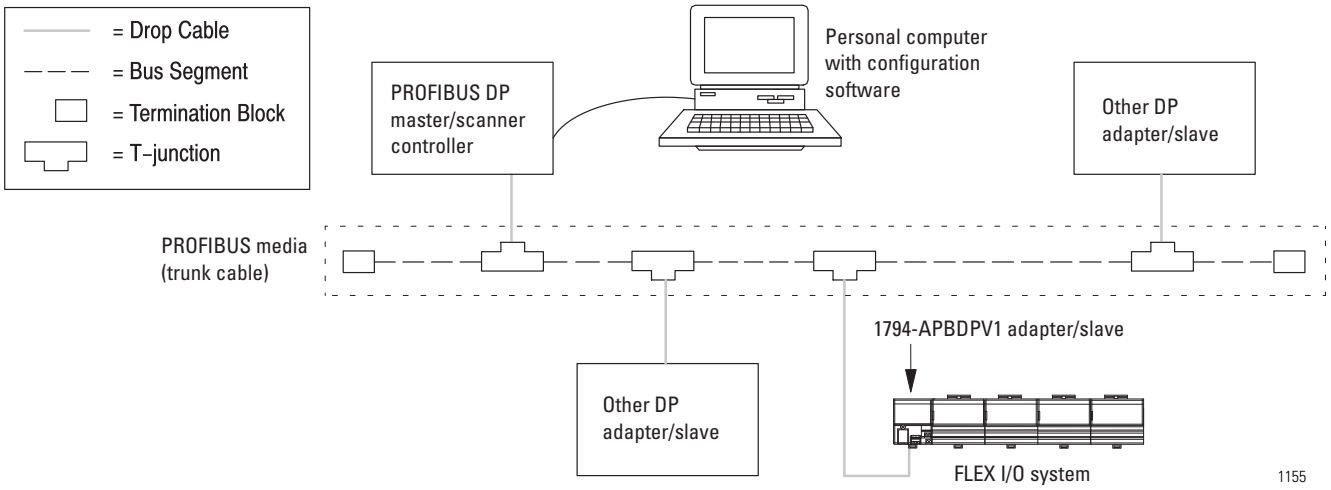
Equipment	Type	Catalog Number	Part Number
Drop cable	Sprecher + Schuh	PTL-2, PTL-4, PDC-10	87.890.282-10
T-junction connector	Sprecher + Schuh	PTS-0	87.890.276-01
Bus segment cable	Sprecher + Schuh	none	299.257.001
Bus segment 1 m	Sprecher + Schuh	PCB-10	87.890.281-10
Connector	Sprecher + Schuh	none	87.890.283-01
Termination Block	Sprecher + Schuh	PCE-0	87.890.284-01

Connect the Adapter to the Network

For line A or B connections,

- use bus segments with t-junctions and termination blocks to form the PROFIBUS media (trunk cable).
- Use termination blocks to terminate the line at each end of the trunk cable.
- Use drop cables to connect devices to the network.

The maximum number of stations on the same network is 32.



Connect Wiring to the Adapter

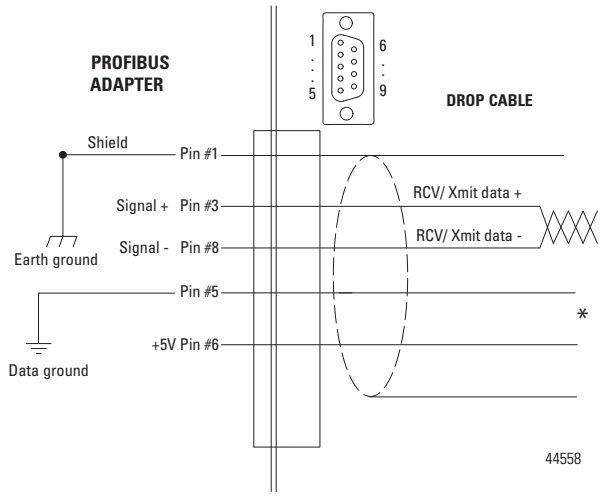
1. Connect the PROFIBUS drop cable to the 9-pin D-shell connector according to the pin assignments in Table D-Shell Pin Assignment on page 75.

ATTENTION: If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

D-Shell Pin Assignment

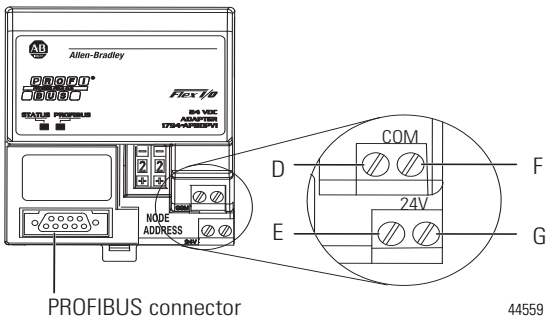
PIN	RS-485 Reference	Signal	Description
1		Shield	Shield, RC to earth ground
2		RP	Not used
3	B/B'	RXD/TXD-P	Receive/transmit data - P
4		CTNR-P	Not used
5	C/C'	DGND	Data ground
6		VP	Voltage plus (+5V)
7		PR	Not used
8	A/A'	RXD/TXD-N	Receive/transmit data - N
9		CTNR-N	Not used
Metal shell			Earth ground

2. Connect the cable shield to pin 1.
   The shield is connected to earth ground.
3. Connect the data signal pins on both ends (signal + pin 3 and signal - pin 8).



* Pins #5 and #6 can be used to supply an external PROFIBUS terminator.

4. Insert the wired connector into the mating connector on the PROFIBUS adapter as shown.



5. Connect +V DC power to the left side of the lower connector, terminal E.

ATTENTION: Total power connection wire length must be less than 10 m (32.8 ft).

6. Connect - V common to the left side of the upper connector, terminal D.
7. Connections G and F are used to pass +V DC power (G) and -V common (F) to the next module in the series (if required).

ATTENTION: When connecting wiring, torque terminal screws D, E, F, and G to 0.8 Nm (7 lb-in).

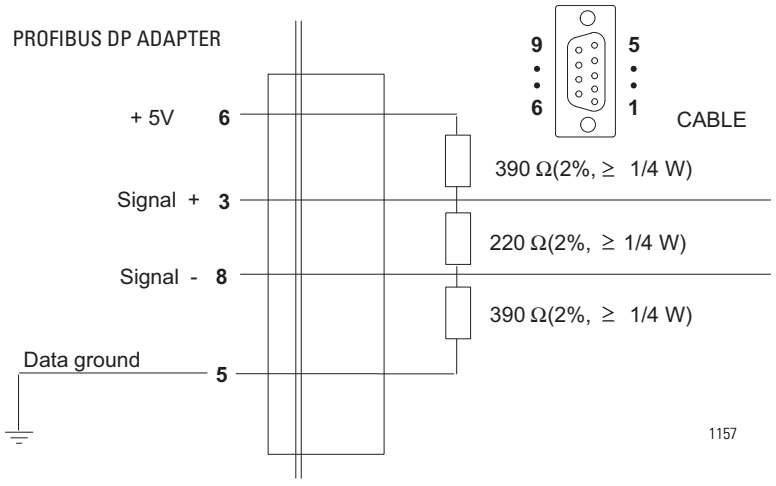
ATTENTION: Do not wire more than two conductors on any single terminal.

Terminate the Network

You must use termination blocks only if your devices on the end of the network do not have built-in terminating resistors. Terminate the PROFIBUS media (trunk cable) at both ends of the network. If you are not using a connector with built-in resistors, terminate the cable at the adapter connector as shown.

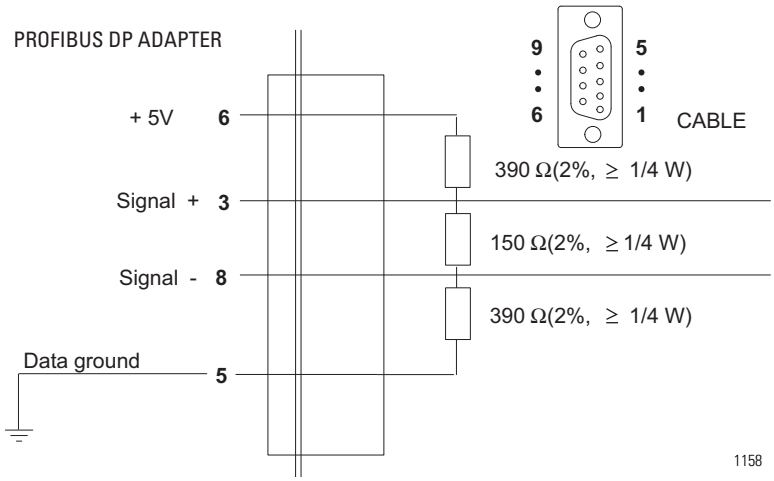
Terminate at the Adapter Using Line A

Since Line A has a higher line impedance, you must use the following termination resistors:



Terminate at the Adapter Using Line B

Use the following termination resistors with line B:



Chapter Summary

In this chapter you learned how to connect your adapter to the PROFIBUS DP network. Read the next chapter to learn about how to configure your adapter for Master/Slave communication

Notes:

Configure the Adapter for Master/Slave Communication

Overview

Read this chapter to familiarize yourself with input, output and configuration files for analog I/O modules on the PROFIBUS network.

For Information On	See Page
How Master/Slave Communication Takes Place	79
Enter User Parameter Data	80
Enter Check Configuration Data	86

How Master/Slave Communication Takes Place

A data exchange between the master and slave cannot be performed until check configuration and send parameter data are issued. Each time you power-up the network, the master sends check configuration and send parameter data to the slave (FLEX I/O adapter).

Check configuration data determines or checks the number of input and output words used by each FLEX I/O module.

Send parameter data contains device-specific parameters you define for each FLEX I/O module.

You need a software configuration tool to set the values associated with these parameters. Since the FLEX I/O adapter is compatible with any master, you can use any compatible configuration tool available.

The Device Database File (GSD) is used by your configuration tool to help you set up your system. Your configuration tool automatically reads the GSD file and extracts defaults used in the data exchange. For more information on GSD files, see Appendix B on page 105.

The file is in ASCII format and you can view it with any text editor. To download a printable copy of your GSD file, see Appendix B on page 105.

The user parameter data fields are not defined in the GSD file. Depending on the format you choose, you may have to manually edit these values with your configuration tool.

For more information on how you define and enter these user parameter values, refer to the documentation associated with your master and software configuration tool.

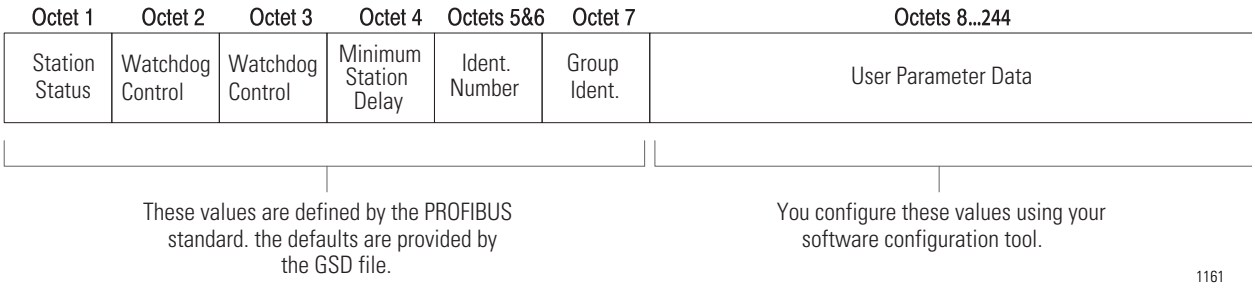
Enter User Parameter Data

Send parameter data is comprised of a string of octets (1...244) that contain 244 bytes of data:

- octets 1...7 contain data specific to the:
  - PROFIBUS Standard
  - defaults contained in the database (GSD) file
- octets 8...244 are user configurable and contain user parameter data. User parameter data consists of these formats:
  - auto configure
  - condensed
  - full

Figure Send Parameter Data Table Structure shows the structure of the send parameter data table.

Send Parameter Data Table Structure



User Parameter Data

The first byte of the user parameter data is the flags byte. This byte selects the appropriate format and also specifies adapter behavior. The flags byte is defined in the following table:

Send Parameter Data Flags Byte

Bit Position	Name	Description
0…1	Format Selection	00 = Auto Configure 01 = Reserved 10 = Condensed 11 = Full
2…3	Fault Action	00 = Reset to zero 01 = Hold Last State 10 = Use Safe State 11 = Reserved
4	Input Fault Action	0 = Reset inputs to zero 1 = Hold Last Value
5	Byte Order of Float values	
6…7	Reserved	Reserved bits must be zero

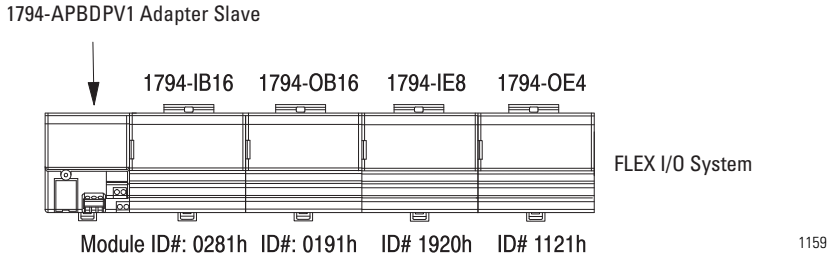
If the send parameter data is received with no user parameter data, the flags byte is set to zero which selects:

- auto configure
- reset outputs to zero on fault
- reset inputs to zero on fault

The reserved bits must be set to zero to prevent undesired firmware update behavior. This is the default behavior of the module as defined in the GSD file.

The descriptions in this chapter use the following example FLEX I/O configuration to explain the information required for each of these functions:

1794-APBDPV1 Adapter Slave



Auto Configure Format

The Auto Configure format allows you to change modules without affecting the User Parameter or Check Configuration data. This format provides no keying from the master on the I/O modules installed in the FLEX I/O system. The installed module at power-up is taken as the key.

If you change a module while it is being controlled by a master, a recoverable fault occurs. To recover from this fault, you must replace the module with an identical module type.

User Parameter Example

User Parameter Message, Auto Configure Format (Length 1 byte)		
Name	**Value**	**Description**
Octet 8:	00h	Auto Configure Format, Reset to Zero on Fault

The complete I/O module real time data table without the module ID, but with the module configuration, is transferred via cyclic PROFIBUS data in one block.

Condensed Format

The condensed format consists of the flags byte and the module key parameter for each of the eight slots. This parameter dictates which I/O module must be installed. If at any time the actual module ID does not match this module key, the slot will be considered in fault and the following occurs:

- Status Indicator flashes red/off

- an error bit in the poll response data is set
- a diagnostic bit in the Ext_Diag_Data field returned in the Read DP-Slave Diagnostic Information message response is set

All eight slots must be configured with the module key parameter. The size for this format depends on the module types which are configured (1 word ID for standar modules, 2 word ID for EDT modules). The range can vary from 20 bytes (including the flags byte) to 36 bytes.

The condensed format structure must be repeated for each of the eight slots.

Data Format for Condensed Format

Name	Size	Description
Module Key	WORD	Module ID # that must be installed(1)

(1) Only bits 0…12 are used. Bits 13…15 must be zero except when keying an empty slot where 0FFFFh is used.

The following table shows the identification numbers for commonly used FLEX I/O modules.

FLEX I/O Module Catalog Number	Module Identification Number (module key)
Four-word Modules	
1794-IB8	0180h
1794-OB8	0190h
1794-IB16	0281h
1794-OB16	0191h
1794-IV16	0204h
1794-OV16	010Ch
1794-IA8	0285h
1794-OA8	0195h
1794-OA8I	019Ch
1794-OW8	0199h
Sixteen-word Modules	
1794-IE8/A	1920h
1794-OE4/A	1121h
1794-IE4XOE2/A	1522h
1794-IE8/B	1924h
1794-OE4/B	1125h
1794-IE4XOE2/B	1526h
1794-IT8	1B00h
1794-IR8	1B01h
1794-IRT8	1B03h
1794-ID2/B	1B03h

FLEX I/O Module Catalog Number	Module Identification Number (module key)
1794-IP4/B	1A04h
1203-FM1	1600h
1794-IE8H/A	1E3F 2003h
1794-OE8H/A	153F 2002h
1797-IE8H/A	1E3F 2001h
1797-OE8H/A	153F 2002h
1794-VHSC/A	1A3F 2000h
1794-IF8IH/A	1E3F 2005h
1794-OF8I/A	153F 2006h
1794-IE8H/B	1E3F 2103h
1794-OE8H/B	153F 2104h
1797-IE8H/B	1E3F 2102h
1797-OE8H/B	153F 2102h

When you use the condensed format, no safe state data can be defined, thus the safe state data is left at the power up default of all zeroes. Setting the Fault Action in the byte to Use Safe State with this format is the equivalent of setting Reset to Zero.

The complete I/O module real time data table without the module ID, but with the module configuration, is transferred via cyclic PROFIBUS data in one block.

User Parameter Example

User Parameter Message, Condensed Format (Length 17 bytes)		
Name	**Value**	**Description**
Octet 8:	02h	Condensed Format, Reset to Zero on Fault, Reset Inputs to Zero
Octet 9-10:	0281h	1794-IB16 16-point discrete input module
Octet 11-12:	0191h	1794-OB16 16-point discrete output module
Octet 13-14:	1920h	1794-IE8 8-point analog input module
Octet 15-16:	1121h	1794-OE4 4-point analog output module
Octet 17-18:	0FFFFh	Empty
Octet 19-20:	0FFFFh	Empty
Octet 21-22:	0FFFFh	Empty
Octet 23-24:	0FFFFh	Empty

Refer to your configuration tool publications for information on how and where to enter this data.

Full Format

The full format consists of the flags byte and four parameters for each of the eight slots. The module key parameter is the same for the full format as defined by the condensed format, but adds three more parameters for each slot.

Use the full format for non EDT I/O modules to:

- provide Safe State values for output points
- send FLEX I/O module configurations once (when you send parameters) instead of every poll
- configure data sizes to reduce the size of data required during run mode

Use the full format for EDT I/O modules to:

- provide Safe State values for output points
- send FLEX I/O module configurations once (when you send parameters) instead of every poll
- configure data sizes to reduce the size of data required during run mode
- configure HART variables data to show in the cyclic PROFIBUS data area.

You must configure all eight slots. The minimum size is 28 bytes – no slots have FLEX I/O module configuration or safe state data. The maximum size is 237 bytes (the size of the PROFIBUS user parameter area).

Data Format for Full Format of Non EDT I/O Module

User Parameter Byte	Name	Size	Description
5, 6	Module Key	WORD	Module ID # that must be installed(2)
7	Module Data Sizes(1)	BYTE	Bits 0…3 Safe State Size (in words) Bits 4…7 Module Configuration Data Size (in words)
8....x	Safe State Data	ARRAY	Output Safe States. Word array of size Safe State Size.
x...y	Module Configuration Data	ARRAY	FLEX I/O Module Configuration. Word array of size Configuration Size.

(1) Each of the two sizes can range from 0…15 words but when combined cannot exceed 15 words total.

(2) Only bits 0…12 are used. Bits 13…15 must be zero except when keying an empty slot where 0xFFFF is used.

Data Format for Full Format of EDT I/O Module

User Parameter Byte	Name	Size	Description
5...8	Module Key	2 WORDS	Module ID # that must be installed[2]
9	Module Data Sizes[1]	BYTE	Bits 0…3 Safe State Size (in words) Bits 4…7 Module Configuration Data Size (in words)
10	Configuration Data Sizes	BYTE	Module Configuration Data Size (in words)
11....X	Safe State Data	ARRAY	Output Safe States. Word array of size Safe State Size.
X...Y	Module Configuration Data	ARRAY	FLEX Module Configuration. Word array of size Configuration Size.
Y...Z	HART Variables Configuration	ARRAY	Y.Byte Bits 0…3 HART loop select of first HART value Y.Byte Bits 4…7 HART loop select of second HART value Y+1.Byte Bits 0…3 HART loop select of third HART value Y+1.Byte bits 4…7 HART loop select of fourth HART value Y+2.Byte Bits 0…1 Variable select of first HART value Y+2.Byte Bits 2…3 Variable select of seoncd HART value Y+2.Byte Bits 4…5 Variable select of third HART value Y+2.Byte Bits 6…7 Variable select of fourth HART value

(1) Each of the two sizes can range from 0…15 words but when combined cannot exceed 15 words total.

(2) Only bits 0…12 are used. Bits 13…15 must be zero except when keying an empty slot where 0xFFFF is used.

There are some possible configurations of FLEX I/O modules that would exceed the user parameter area of 237 bytes. Be aware of the totals of the words and modules you are using.

User Parameter Example

User Parameter Message, Full Format (Length 43 bytes)		
Name	**Value**	**Description**
Octet 8:	02h	Full Format, Reset to Zero on Fault
Octet 9…10:	0281h	Slot 1 Module key 1794-IB16 16-point discrete input module
Octet 11:	10h	Slot 1 config size 1 word, safe state size 0 words
Octet 12…13:	0000h	1 config word, input delay times
Octet 14…15:	0191h	Slot 2 Module Key 1794-OB16 16-point discrete output module
Octet 16:	01h	Slot 2 config size 0 words, safe state size 1 word
Octet 17…18:	0000h	1 safe state data word, safe state value for output points
Octet 19…20:	1920h	Slot 3 Module Key 1794-IE8 8-point analog input module
Octet 21:	10h	Slot 3 config size 1 word, safe state size 0 words
Octet 22…23:	0000h	1 config word, channel slection
Octet 24…25:	5121	Slot 4 Module Key 1794-OE4 4-point analog output module
Octet 26:	24h	Slot 4 config size 2 words, safe state size 4 words
Octet 27…28:	0000h	2 config words – channel selection and
Octet 29…30:	0000h	output enabled
Octet 31…32:	0000h	4 safe state data words – safe state size 4 words

User Parameter Example

User Parameter Message, Full Format (Length 43 bytes)		
Name	**Value**	**Description**
Octet 33…34:	0000h	output point 2
Octet 35…36:	0000h	output point 3
Octet 37…38:	0000h	output point 4
Octet 39…40:	0FFFFh	Slot 5 empty
Octet 41:	00h	Slot 5 all sizes zero
Octet 42…43	0FFFFh	Slot 6 empty
Octet 44:	00h	Slot 6 all sizes zero
Octet 45…46:	0FFFFh	Slot 7 empty
Octet 47:	00h	Slot 7 all sizes zero
Octet 48…49:	0FFFFh	Slot 8 empty
Octet 50:	00h	Slot 8 all sizes zero

Refer to your configuration tool publications for information on how and where to enter this data.

Enter Check Configuration Data

On a PROFIBUS DP network, the I/O data exchanged between the PROFIBUS DP master and a DP slave is encapsulated into logical modules. The total I/O data exchanged between a PROFIBUS DP master and a DP slave device comprises a set of logical modules which is defined in the check configuration data.

Each physical slot of the FLEX I/O system is represented by two logical modules (one input and one output). When the FLEX I/O adapter is powered-up, the check configuration message configures the module format (input and output words) and defines the size of the modules within the device. When the sizes are configured, the I/O data can be optimized to remove unused data from the data stream.

Both input and output sizes can be configured. If a slot is empty, or if either the input or output module is zero length, the specific identifier for an empty module (free place) must be used.

If the end of the identifiers is reached before all slots have been configured, the remaining slots are configured as empty.

The first two modules allocated are for the adapter itself, and must always be a 1 word input module and a 1 word output module, regardless of what parameter format you choose. The adapter uses these words for adapter status information. Modules for each of the individual slots (FLEX I/O modules) must also follow these word assignments.

The format of the adapter status word is defined in the following table:

Adapter Status Word

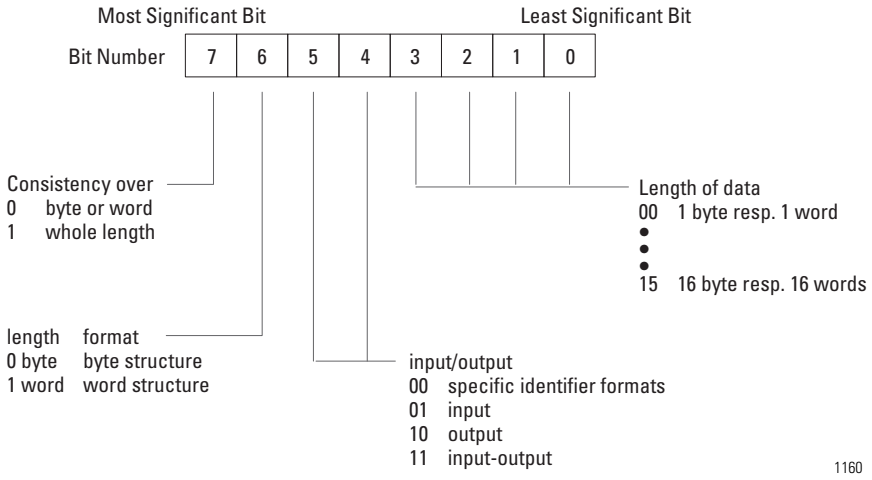
Input Status Word		
Bit Position	**Name**	**Description**
0	Address Change	This bit is set when the Node Address switch is changed since power up.
1…7	Reserved	Sent as zeroes.
8…15	I/O Module Fault	This bit is set when an error is detected in a slot position (bits 0…7 refer to slots 1…8).
Output Status Word		
Bit Position	**Name**	**Description**
0…15	Reserved	sent as zeroes.

I/O Module Faults are caused by:

- transmission errors on the FLEX I/O backplane
- bad module
- removed module
- incorrect module inserted

The adapter expects the identifier area for each of the eight FLEX I/O slots to be 2 bytes. The DP input/output identifier and all specific DP identifiers (except the empty module) are not supported.

The identifier byte and its format are described in the following illustration. This byte is defined in Part 3 of the PROFIBUS Standard.



The maximum size of this identifier area is 17 bytes. If no FLEX I/O modules are installed in the upper slots, the length may be less. Consistency must be over a word.

Check Configuration Example

Check Configuration Message when used with Send Parameter Auto Configure or Condensed Format (Length 10 bytes)		
Name	**Identifier Byte**	**Description**
Octet 1:	50h	Input Status Word (input – 1 word)
Octet 2:	60h	Output Status Word (output – 1 word)
Octet 3:	51h	Slot 1, input module 2 words
Octet 4:	60h	Slot 1, output module 1 word
Octet 5:	00h	Slot 2, input module empty
Octet 6:	60h	Slot 2, output module 1 word
Octet 7:	57h	Slot 3, input module 8 words
Octet 8:	60h	Slot 3, output module 1 word
Octet 9:	50h	Slot 4, input module empty
Octet 10:	65h	Slot 4, output module 6 words
I/O sizes configured: 22 input bytes, 20 output bytes		

Refer to your configuration tool publications for information on how and where to enter this data.

Check Configuration Example

Check Configuration Message when used with Send Parameter Full Format (Length 10 bytes)		
Name	**Identifier Byte**	**Description**
Octet 1:	50h	Status Word (input – 1 word)
Octet 2:	60h	Output Status Word (output – 1 word)
Octet 3:	51h	Slot 1, input module 2 words
Octet 4:	00h	Slot 1, output module 1 word
Octet 5:	00h	Slot 2, input module empty
Octet 6:	60h	Slot 2, output module 1 word
Octet 7:	57h	Slot 3, input module 8 words
Octet 8:	00h	Slot 3, output module 1 word
Octet 9:	00h	Slot 4, input module empty
Octet 10:	63h	Slot 4, output module 6 words
I/O sizes configured: 22 input bytes, 12 output bytes		

Refer to your configuration tool publications for information on how and where to enter this data.

The read configuration message response returns the current configuration data. At power up, the configuration is the maximum read and write sizes supported by each FLEX I/O module.

A valid check configuration message updates the internal configuration. The updated internal configuration is then returned in the message response.

Power Up Configuration Example

Read Configuration Message response at Power Up (Length 10 bytes)		
Name	**Identifier Byte**	**Description**
Octet 1:	50h	Status Word (input – 1 word)
Octet 2:	60h	Output Status Word (output – 1 word)
Octet 3:	51h	Slot 1, input module 2 words
Octet 4:	60h	Slot 1, output module 1 word
Octet 5:	50h	Slot 2, input module empty
Octet 6:	61h	Slot 2, output module 1 word
Octet 7:	58h	Slot 3, input module 8 words
Octet 8:	65h	Slot 3, output module 1 word
Octet 9:	50h	Slot 4, input module empty
Octet 10:	65h	Slot 4, output module 6 words
I/O sizes configured: 22 input bytes, 12 output bytes		

Refer to your configuration tool publications for information on how and where to enter this data.

Chapter Summary

In this chapter you learned about input, output and configuration files. Read the next chapter to learn how to troubleshoot your module.

Notes:

Interpret Status Indicators for the FLEX I/O PROFIBUS Module

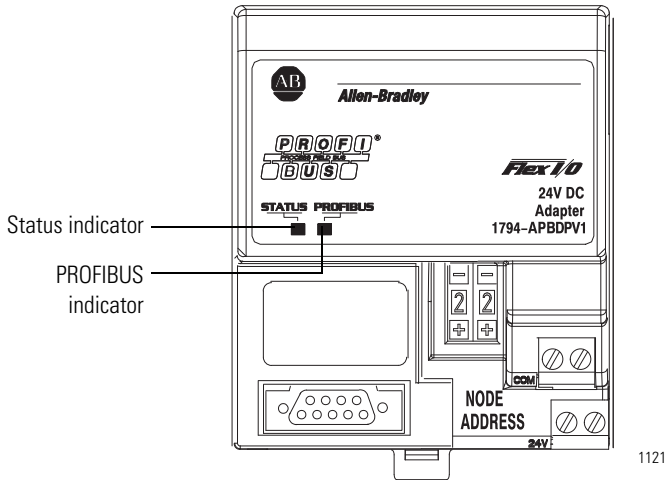
Overview

Read this chapter to troubleshoot your I/O module.

For Information On	See Page
Status Indicators	91
View status from the Master's Configuration Software	92

Status Indicators

1794-APBDPV1 Module



Locate the two bi-color indicators on the front panel of the adapter. They show both normal operation and fault conditions in your FLEX I/O PROFIBUS system. The indicators are:

- STATUS – this indicator provides device status
- PROFIBUS – this indicator provides communication link status

Use the following tables to determine the indicator conditions and status.

Status Indicator

Status	Description	Recommended Action
OFF	No power applied to device	Apply power to device.
Solid green	Device operating normally	None.
Flashing red/OFF	Recoverable fault - FLEX I/O module bad - Incorrect FLEX I/O module installed - External flash checksum error - Node address changed since power up	Cycle power to device. Verify the FLEX I/O modules installed. Verify the FlexBus connectors and communication. Verify the confiruguration. If condition persists, replace device.
Solid red	Unrecoverable fault - Checksum error in program flash - 3.3V power supply error - External flash write error	Replace device.

PROFIBUS Indicator

Status	Description	Recommended Action
OFF	No power or no communication No cyclic communication active, WDT timeout	Apply power to device. Establish PROFIBUS communication.
Solid green	Data is being transmitted and received	None.
Flashing red/OFF	Recoverable fault - Invalid Send Parameter data - Invalid Check Configuration data	Verify that device is properly installed, and reinstall as needed.
Solid red	Unrecoverable fault - Unable to communicate	Replace device.

View status from the Master's Configuration Software

You can use read diagnostics to view status using the master's configuration software. The adapter returns identification in response to the Read DP–Slave Diagnostic Information message.

Read DP – Slave Diagnostics Information Message

Ext_Diag_Data field (Length 9 bytes)	
Octet	**Description**
7	Device Related diagnistic header byte (05h)
8	Revision – Minor
9	Revision – Major
10	Adapter Status Bit 0 – Node Addres Changed Bits 1…7 – Reserved
11	Node Address switch setting
12	Identifier Related diagnostic header byte (44h)
13…15	Identifier diagnostic bits[1]

(1) One identifier bit for each logical module (adapter and each slot use two identifier bits). The bits set indicate a module fault.

Chapter Summary

In this chapter you learned how to troubleshoot the FLEX I/O PROFIBUS adapter module. Refer to FLEX I/O PROFIBUS Adapter Installation Instructions, publication 1794-IN114 for complete specifications for your module.

Read the next chapter to learn how to apply the FLEX I/O analog modules.

Notes:

Apply FLEX I/O Modules

Overview

Read this chapter to learn how to use entity parameters when electrically interconnecting your FLEX I/O module in a hazardous area.

For Information On	See Page
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Evaluate the Application

Follow these steps when designing a FLEX I/O system for your application:

1. Define the area classification.
2. Select protection method(s).
3. Match field devices and I/O modules.
4. Optimize power distribution.
5. Layout the PROFIBUS network.

An explanation of each of these steps is provided in this chapter.

Define the Area Classification

Before you can determine what components will make up your FLEX I/O system, you must define the area in which that system will operate. You must determine the following:

- Classification method
- Hazard
- Temperature rating

Decide Classification Method

Your application location will usually decide whether the classification method is Zone or Class/Division, but the system designer may make this determination. FLEX I/O **IS CERTIFIED FOR ZONE METHOD ONLY**. Certification is pending for Division method.

Determine Hazard

Hazard, typically gas, dust, or fibers, is determined by the material being processed. For example, a coal mine will generally be rated for dust and methane gas hazards. FLEX I/O **IS CERTIFIED FOR GAS HAZARD ONLY**. Certification is pending for attaching wiring to FLEX I/O modules from a dust and fiber hazardous area.

Determine Temperature Rating

The spontaneous ignition temperature of the hazard in your application determines the temperature rating. For example, an application with a hydrogen hazard may use equipment with a temperature rating of T1 because hydrogen's ignition temperature is 550 °C. FLEX I/O **IS CERTIFIED AS A T4 SYSTEM**.

Select Protection Method(s)

Although the FLEX Ex system primarily uses the Intrinsic Safety protection method, the system uses all methods listed below.

Protection Methods for Hazardous Applications

Protection Method	Designation[1(1)]	Method of Achieving Protection
Intrinsic Safety	EEx_{ia}/EEx_{ib}	Energy Limiting
Encapsulation	EEx_{m}	Segregation
Increased Safety	EEx_{e}	Refined Mechanical Design
Flameproof	EEx_{d}	Containment

(1) In the Non-Incendive protection method, n: used locally in the United States and United Kingdom.
In the Intrinsic Safety method, ia: Zone 0, 1, 2 & ib: Zone 1, 2.

IMPORTANT As not all protection methods are applicable for all locations, consult local certifying agencies to determine acceptable protection methods for your application.

WARNING: The FLEX I/O PROFIBUS APBDPV1 adapter cannot be used within an intrinsically safe area but can be connect to a FLEX Ex system in an intrinsically safe area from outside the safe zone by using the 1797-BIC and 1797-CEC with the FLEX Ex extension cables.
For more information on how to use FLEX I/O PROFIBUS APBDPV1 adapter modules with a FLEX Ex system, refer to the FLEX Ex Bus Isolator and Flexbus Connector Installation Instructions, publication 1797-IN513.

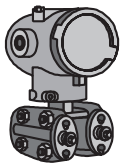
Match Field Devices and I/O Modules

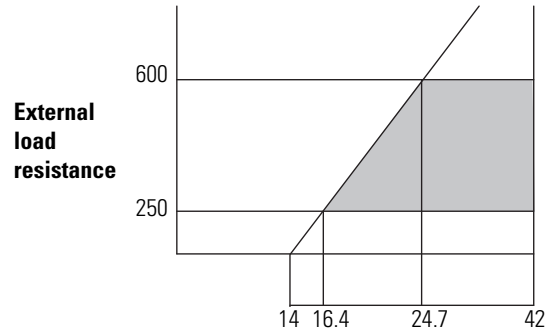
You must match field devices and I/O modules for your application to function properly. Consider the following:

- Verify field device and I/O module operational characteristics
- Match entity parameters of field devices and I/O modules

P/I Analog Transmitter Functional and IS Parameters

The figure below shows a typical pressure to current analog transmitter. Two types of characteristics are shown, functional and IS.

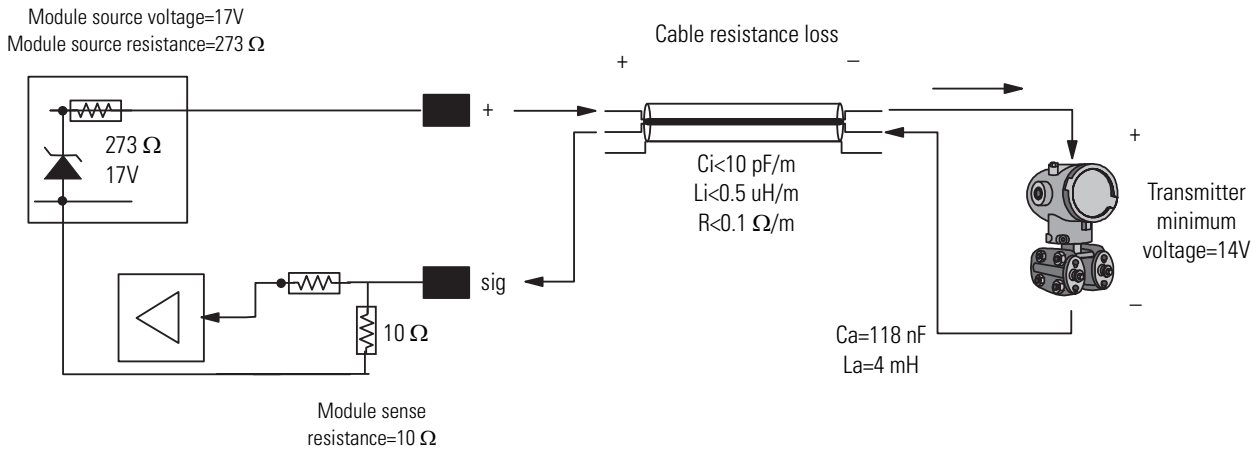




Loop Functionality Verification

The functional characteristics will be checked first. The figure below shows the general situation which must be analyzed for proper loop function.

On the left are the module components of the voltage source to run the loop and its internal source resistance. In the center is the cable. It represents a loss with regard to its resistance. Cable resistance is a function of cable length. On the right is the transmitter, which has a minimum voltage it must see to function properly.



The loop must function properly under maximum signal current conditions, in this case 22 mA. As can be seen the key variable, which must be determined, is the total loop resistance. This may be determined with the following equation:

$$Rtotal = \frac{(23.7\text{-}14)}{0.022} = 440\ \Omega$$

Once Rtotal is known, you must determine the actual cable resistance that can be accommodated. This is the difference between Rtotal and the module internal source and sense resistances: Rcable=440-273-10=157 Ω.

Rcable is used to determine the wiring length allowed between the module and the transmitter:

$$Cable\_length = \frac{157}{2*0.1} = 785 \text{ m}$$

Note, the 2 in the denominator of the equation is necessary to account for the resistance of both cable conductors (signal source + and signal and return).

Chapter Summary

In this chapter you learned how to apply the FLEX I/O analog modules.

Notes:

Specifications

Overview

This appendix contains general and environmental specifications and certifications for the FLEX I/O PROFIBUS Adapter Module – 1794-APBDPV1.

Technical Specifications

Attribute	Value
I/O module capacity	8
Communication rate	All rates up to 12.0 Mbits/s
Input voltage range	19.2V…31.2V DC (includes 5% AC ripple)
Input voltage, nom	24V DC
Input current, max	385 mA, 309 mA @ 24V DC
Inrush current	23 A for 2 ms
FlexBus	640 mA @ 5V DC
Isolation voltage	50V (continuous), Basic Insulation Type PROFIBUS to FLEX backplane to power Routine tested @ 850V DC for 1 s, PROFIBUS to Backplane to Power Type tested @ 850V AC for 60 s, PROFIBUS to Backplane to Power
Power dissipation, max	4.2W @ 19.2V DC
Thermal dissipation	14 BTU/hr @ 19.2V DC
PROFIBUS connector	9-pin D-shell
PROFIBUS cable	Standard drop cable
Terminal screw torque	0.8 Nm (7 in-lb)
Wire size Power	0.33... 3.31 mm^2 (22...12 AWG) solid or stranded copper wire rated @ 115 °C (239 °F) or greater, 1.2 mm (3/64 in.) insulation max
Wire category	1 – on power port(1) 2 – on communication ports
North American temperature code	T4
IEC temperature code	T4
Dimensions, approx. (HxWxD)	87 x 69 x 69 mm 3.4 x 2.7 x 2.7 in.

Environmental Specifications

Attribute	Value
Temperature, operating	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0…55 °C (32…131 °F)
Temperature, surrounding air, max	55 °C (131 °F)
Temperature, nonoperating	IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock): -40…85 °C (-40…185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Nonoperating Damp Heat): 5…95% noncondensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5 g @ 10…500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50 g
Emissions	CISPR 11: Group 1, Class A
ESD immunity	IEC 61000-4-2: 6 kV contact discharges 8 kV air discharges
Radiated RF immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80… 2500 MHz 3V/m with 1 kHz sine-wave 80% AM from 2500…2700 MHz
EFT/B immunity	IEC 61000-4-4: ±4 kV @ 2.5 kHz on power ports ±2 kV @ 5 kHz on communication ports
Surge transient immunity	IEC 61000-4-5: ±2 kV line-earth (CM) on communication ports
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz

Certifications

Certification[1] (When marked on product)	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2004/108/IEC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)

Certifications

C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: EN 60079-15; Potentially Explosive Atmospheres, Protection "n" EN 60079-0; General Requirements II 3 G Ex nA II T4 X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) See the Product Certification link at http://www.rockwellautomation.com/products/certification/ for Declaration of Conformity, Certificates, and other certification details.

Notes:

Device Data Base (GSD) File

Overview

This PROFIBUS adapter requires a GSD file for implementation.

This file is available for downloading from http://www.rockwellautomation.com/rockwellautomation/support/networks/gsd.page. The GSD file is used by your configuration tool to help you set up your system. Your configuration tool automatically reads the GSD file and extracts defaults used in the data exchange. The file is in ASCII format and you can view it with any text editor.

This device data base file changes when new FLEX I/O modules are introduced. To use an I/O module not included in the GSD file that you have downloaded, you need to update the GSD file with a teaching entry for your new I/O modules.

Go to the GSD website and locate the GSD file for your 1794-APBDPV1 adapter module.

IMPORTANT **Before Using the Teaching GSD Feature**

To effectively create a teaching GSD file for your module, you need to be familiar with the I/O data table for your module. The I/O data table is usually available in the User Manual specific to your module.

For FLEX I/O modules, user manuals are available in the Literature Library: http://www.rockwellautomation.com/literature

Note that each I/O module profile is unique. The examples used in this document serve to illustrate the Teaching GSD process only.

Use the Teaching GSD Feature

The Teaching feature allows a new I/O module to work with a 1794-APBDPV1 adapter firmware. It allows the adapter to support the new I/O module and read the I/O module's identity, configuration, and I/O information and work with the module.

This section involves two steps:

- Create Standard and Teaching GSD Files on page 106 shows you how to create a teaching and standard GSD file that are required to teach your adapter to work with any new I/O module. It also provides a description of the different parameters in a teaching file entry and corresponding byte information for each parameter.
- Teach an I/O Module to Work with 1794-APBDPV1 Adapter on page 115 provides a step-by-step procedure on how to teach a new I/O module to work with the 1794-APBDPV1 adapter through the GSD file.

Create Standard and Teaching GSD Files

To start, you need to have a standard GSD file and a teaching GSD file. Follow these steps.

1. Download the current GSD file from the following website: http://www.rockwellautomation.com/rockwellautomation/support/networks/gsd.page.
2. Using the downloaded file, create a standard GSD file. You can rename this file copy as *_standard.gsd.
3. In the standard GSD file, you need to create entries for your new I/O module in the following formats:
   - Auto
   - Condensed
   - Full

IMPORTANT The following examples in the next steps illustrate the format for standard GSD entries.

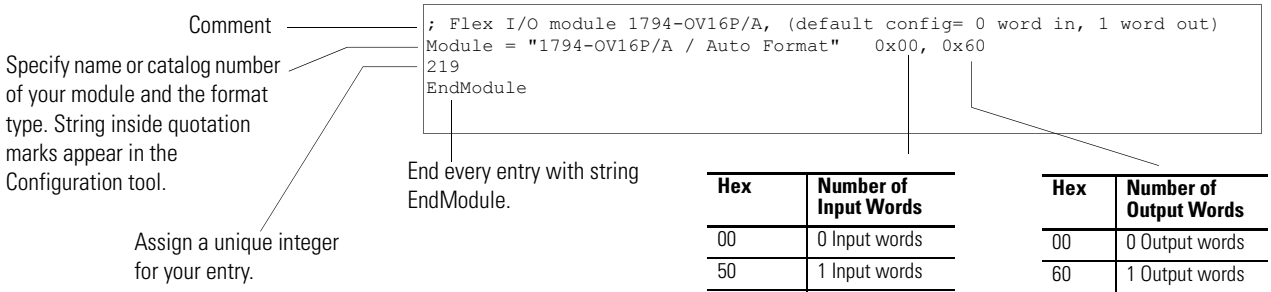
For detailed descriptions of parameters in the standard GSD file, refer to the GSD File Specification for Profibus.

4. Create an Auto format entry for your module following the format shown below.

TIP You can refer to existing Auto format entries in the GSD file as template. See the User Manual for your I/O module to help you specify the number of input and output words and other parameters required in the GSD file.

For example, you have a 1794-OV16P module.

Standard Auto Format Entry

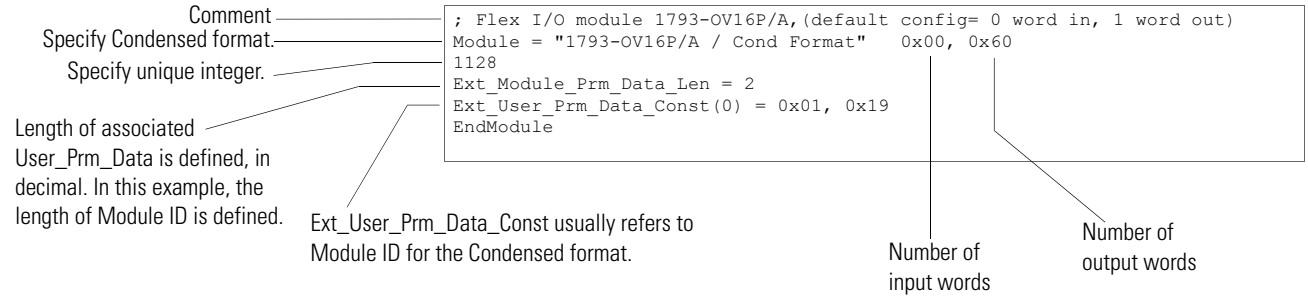

Comment
Specify name or catalog number of your module and the format type. String inside quotation marks appear in the Configuration tool.
Assign a unique integer for your entry.
End every entry with string EndModule.
; Flex I/O module 1794-OV16P/A, (default config= 0 word in, 1 word out)
Module = "1794-OV16P/A / Auto Format" 0x00, 0x60
219
EndModule

Hex	Number of Input Words
00	0 Input words
50	1 Input words
51	2 Input words
52	3 Input words
53	4 Input words
...	...

Hex	Number of Output Words
00	0 Output words
60	1 Output words
61	2 Output words
62	3 Output words
63	4 Output words
...	...

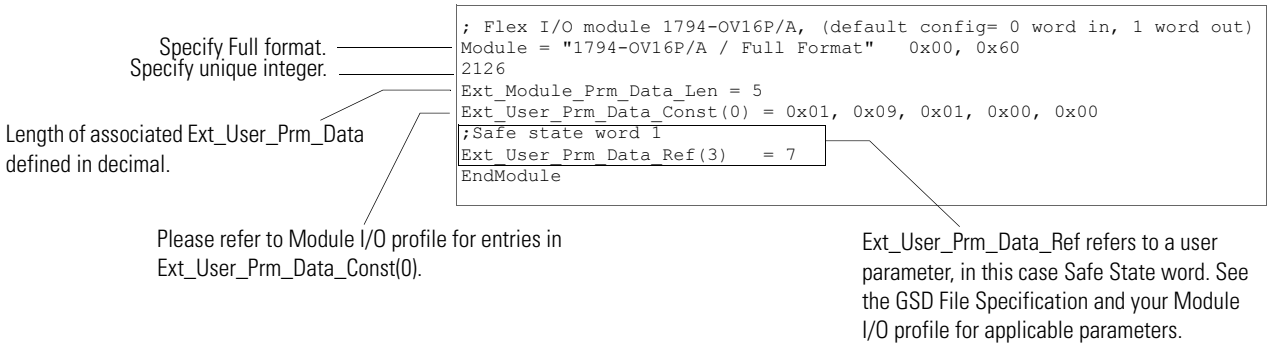
5. Create another entry for your module in Condensed format following the format shown below. Copy your Auto format entry and update with the required parameters for the Condensed format, as shown below.

Standard Condensed Format Entry


Comment
Specify Condensed format.
Specify unique integer.
Length of associated User_Prm_Data is defined, in decimal. In this example, the length of Module ID is defined.
; Flex I/O module 1793-OV16P/A,(default config= 0 word in, 1 word out)
Module = "1793-OV16P/A / Cond Format" 0x00, 0x60
1128
Ext_Module_Prm_Data_Len = 2
Ext_User_Prm_Data_Const(0) = 0x01, 0x19
EndModule
Ext_User_Prm_Data_Const usually refers to Module ID for the Condensed format.
Number of input words
Number of output words

6. Create an entry in Full format for your module following the format shown below.

Standard Full Format Entry


Specify Full format.
Specify unique integer.
Length of associated Ext_User_Prm_Data defined in decimal.
; Flex I/O module 1794-OV16P/A, (default config= 0 word in, 1 word out)
Module = "1794-OV16P/A / Full Format" 0x00, 0x60
2126
Ext_Module_Prm_Data_Len = 5
Ext_User_Prm_Data_Const(0) = 0x01, 0x09, 0x01, 0x00, 0x00
;Safe state word 1
Ext_User_Prm_Data_Ref(3) = 7
EndModule
Please refer to Module I/O profile for entries in Ext_User_Prm_Data_Const(0).
Ext_User_Prm_Data_Ref refers to a user parameter, in this case Safe State word. See the GSD File Specification and your Module I/O profile for applicable parameters.

7. Save the standard GSD file.
8. Using the downloaded GSD file, create a teaching GSD file. You can rename this file copy as *_teaching.gsd. Create a teaching entry in Full format in this file.
   The next sections will show you the format and the different parameters for your teaching entry.

Teaching GSD Entry

There are two types of Teaching entry: EDT (Extended Data Transfer) module teaching entry and non-EDT module teaching entry.

EDT (Extended Data Transfer) and Non-EDT Modules

There are two types of FLEX I/O modules: EDT modules which support EDT data and non-EDT modules which do not support EDT data. FLEX I/O

modules, such as 1794-IE8H, 1794-IF8IH and other FLEX HART I/O modules, support HART data via the EDT protocol.

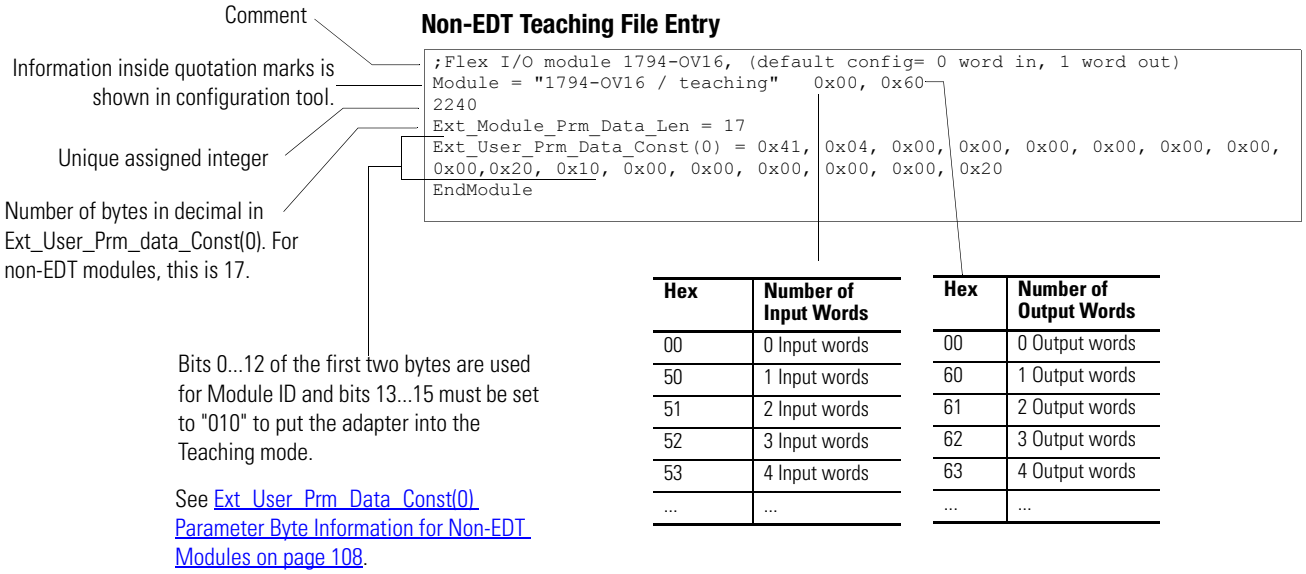
EDT and non-EDT modules have different teaching GSD entries. See the next sections for details.

For more information about the EDT protocol, see the User Manual for your FLEX I/O HART module available in the Literature Library: http://literature.rockwellautomation.com/

Non-EDT Module Teaching Entry

The following shows a teaching entry for non-EDT modules in a standard GSD file, where 1794-OV16 is the sample I/O module being "taught".

Non-EDT Teaching File Entry


Comment
Information inside quotation marks is shown in configuration tool.
Unique assigned integer
Number of bytes in decimal in Ext_User_Prm_data_Const(0). For non-EDT modules, this is 17.
;Flex I/O module 1794-OV16, (default config= 0 word in, 1 word out)
Module = "1794-OV16 / teaching" 0x00, 0x60
2240
Ext_Module_Prm_Data_Len = 17
Ext_User_Prm_Data_Const(0) = 0x41, 0x04, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,0x20, 0x10, 0x00, 0x00, 0x00, 0x00, 0x00, 0x20
EndModule

Hex	Number of Input Words
00	0 Input words
50	1 Input words
51	2 Input words
52	3 Input words
53	4 Input words
...	...

Hex	Number of Output Words
00	0 Output words
60	1 Output words
61	2 Output words
62	3 Output words
63	4 Output words
...	...

Bits 0...12 of the first two bytes are used for Module ID and bits 13...15 must be set to "010" to put the adapter into the Teaching mode.

See Ext_User_Prm_Data_Const(0) Parameter Byte Information for Non-EDT Modules on page 108.

The following table provides byte descriptions for the Ext_User_Prm_Data_Const(0) parameter.

Ext_User_Prm_Data_Const(0) Parameter Byte Information(1) for Non-EDT Modules

Byte	Definition
1	Teaching Key / Module
2	Module ID
3	Module Data Size (0)
4	Start address of digital input in bits
5	Length of digital input in bits
6	Start address of analog input in bits
7	Length of analog input in bits
8	Start address of status information in bits

Ext_User_Prm_Data_Const(0) Parameter Byte Information[1] for Non-EDT Modules

Byte	Definition
9	Length of status information in bits
10	Start address of digital output in bits
11	Length of digital output in bits
12	Start address of analog outputs in bits
13	Length of analog outputs in bits
14	Start address of configuration in bits
15	Length of configuration in bits.
16	
17	Special module settings

(1) See Ext_User_Prm_Data_Const(0) Byte Description and Examples for Non-EDT Modules on page 109 for more details about each byte.

For example, an I/O module has the following RTD (Real Time data) I/O Profile:

Example RTD I/O Profile for Sample Non-EDT Module

RTD Index	Assembly Index	Assembly
RTD 0	MSW	Module Status Word
RTD 1...8	I:0...I:7	RTD Status Data
RTD 9...10	S0:...S1	RTD Status Data
RTD 11	O:0	RTD Output Word
RTD 12...13	C0:...C1	RTD Configuration Word

In the Teaching entry in the GSD file, all the input, output and configuration data are RTD (Real Time Data) / Cyclic Data, not the EDT I/O and configuration data.

Ext_User_Prm_Data_Const(0) Byte Description and Examples for Non-EDT Modules

Byte	Description	Example
Byte 1	Bits 0...12 of first two bytes are used for module ID and bits 13...15 must be set to "010" (0x40) to put the adapter into the Teaching mode. For example, if the module ID is 0x15, 0x03, then first byte of Module ID is **0x55** (0x15 + 0x40).	Ext_User_Prm_Data_Const(0) = **0x55**, 0x03, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX0, 0xXX0, 0xXX
Byte 2	Second byte of Module ID.	Ext_User_Prm_Data_Const(0) = 0x55, **0x03**, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX0, 0xXX0, 0xXX
Byte 3	This byte should always be **0x00** in a teaching entry.	Ext_User_Prm_Data_Const(0) = 0x55, 0x03, **0x00**, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX0, 0xXX0, 0xXX

Ext_User_Prm_Data_Const(0) Byte Description and Examples for Non-EDT Modules

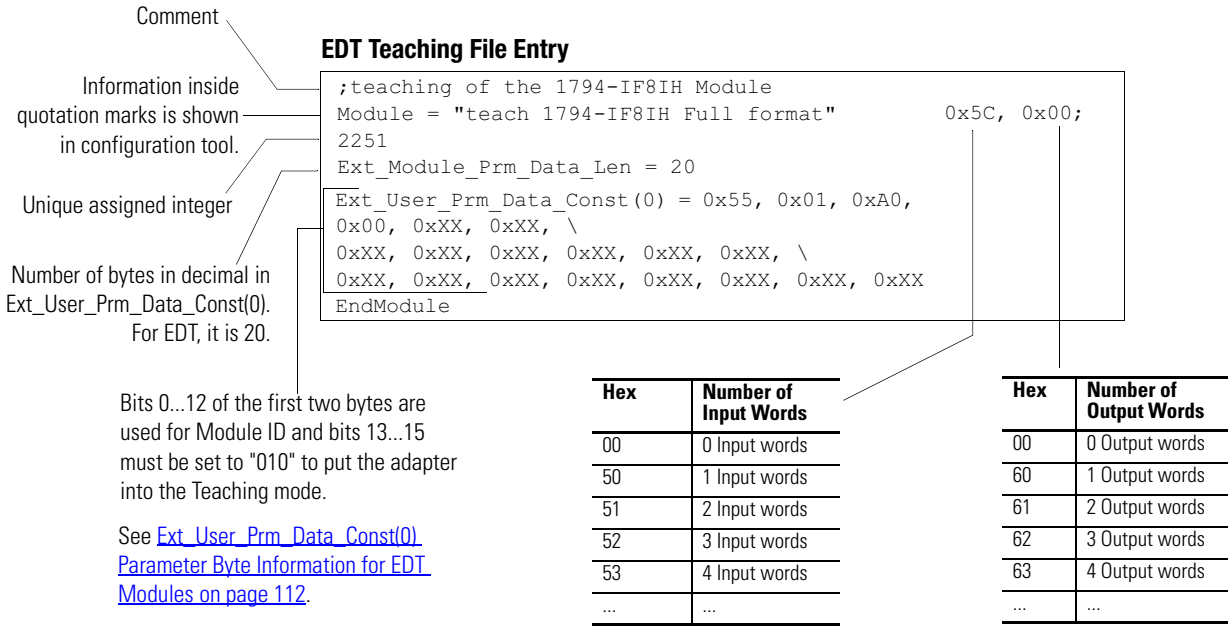
Byte 4	The start address of digital input in bits.	For digital input modules, the start address (in bits) of input (RTD 1), based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is 16 bits (RTD0), that is, 0x10. For analog input modules and non-input modules, this byte is **0x00**.
Byte 5	The length of digital inputs in bits.	For digital input modules, the length of digital inputs, based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is **0x80**(I:0 to I:7). For analog input modules and non-input modules, this byte is **0x00**.
Byte 6	The start address of analog input in bits.	For analog input modules, the start address (in bits) of input (RTD 1), based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is 16 bits(RTD0), that is, **0x10**. For digital input modules and non-input modules, this byte is **0x00**.
Byte 7	The length of analog inputs in bits.	For analog input modules, the length of analog inputs, based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is **0x80**(I:0 to I:7). For digital input modules and non-input modules, this byte is **0x00**.
Byte 8	The start address of Status information in bits.	Based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, the start address (in bits) of Status Information (RTD 9) is 16(RTD 0) + 128(RTD 1…RTD 8) = 144 bits, that is, **0x90**. If there is no Status Information byte in above I/O profile table then this byte is **0x00**.
Byte 9	The length of Status information in bits.	Based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, the length (in bits) is 32(2 words, S0 .. S1), that is, **0x20**. If there is no Status Information byte in the I/O profile table then this byte is **0x00**.
Byte 10	The start address of digital output in bits.	For digital output modules, the start address (in bits) of output (RTD 11) based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is 16(RTD 0) + 128 (RTD 1…RTD 8) + 32(RTD 9…RTD 10) = 176 bits, that is, 0xB0. For analog output modules and non-output modules, this byte is **0x00**.
Byte 11	The length of digital output in bits.	For digital input modules, the length of digital output, based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is **0x10**(O:0). For analog input modules and non-output modules, this byte is **0x00**.
Byte 12	The start address of analog output in bits.	For analog output modules, the start address (in bits) of output (RTD 11) based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is 16(RTD 0) + 128 (RTD 1…RTD 8) + 32(RTD 9…RTD 10) = 176 bits, that is, **0xB0**. For digital output modules and non-output modules, this byte is **0x00**.
Byte 13	The length of analog output in bits.	For analog output modules, the length of analog output based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, is **0x10**(O:0). For digital input modules and non-output modules, this byte is **0x00**.

Ext_User_Prm_Data_Const(0) Byte Description and Examples for Non-EDT Modules

Byte 14	The start address of Configuration in bits.	Based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, the start address (in bits) of configuration (RTD 12) will be 16(RTD0) + 128 (RTD 1…RTD 8) + 32 (RTD 9…RTD 10) + 16(RTD 11) = 192 bits, that is, **0xC0**. If there is no Configuration Information byte in the RTD I/O profile table, then this byte is **0x00**.
Byte 15...16	The length of Configuration in bits.	Configuration length is specified in two bytes. Based on Example RTD I/O Profile for Sample Non-EDT Module on page 109, the length (in bits) is 32(2 words, C0 .. C1)= **0x00**, **0x20**. If there is no Configuration Information byte in the RTD I/O profile table, then these bytes are **0x00**, **0x00**.
Byte 17	Special module settings byte. The adapter supports different types of safe state behavior and other module-specific procedures. This byte defines how the adapter handles the module for teaching.	**Bit 0...3** Reserved (must be set to 0). **Bit 4** 1 = the module supports Cyclic EDT Assemblies. 0 = the module does not support Cyclic EDT Assemblies. **Bit 5** 1 = I/O module must not be configured as CEDT HART I/O module. 0 = I/O module must be configured as CEDT HART I/O module. **Bit 6** 1 = bit 14 of the first write word in RTD (FAULT) is set to enable outputs and is cleared to disable the outputs on the I/O module. 0 = no action on bit 14 of the first write word in RTD. **Bit 7** 1 = bit 15 of the first write word in RTD (RUN) is set to enable the outputs and is cleared to disable the outputs on the I/O module. 0 = no action on bit 15 of the first write word in RTD (RUN). If the I/O module does not support cyclic EDT (that is, bit 4 is 0) and it does not support HART protocol (that is, bit 5 is 1) and no action on bit 14 and 15 of the first word in RTD (RUN) (bits 6...7 are 0), then this byte is **0x20**.

EDT Modules Teaching Entry

The following example shows the teaching entry format for EDT modules, where 1794-IF8IH HART I/O module is a sample EDT module being taught.


Comment
Information inside quotation marks is shown in configuration tool.
Unique assigned integer
Number of bytes in decimal in Ext_User_Prm_Data_Const(0). For EDT, it is 20.
Bits 0...12 of the first two bytes are used for Module ID and bits 13...15 must be set to "010" to put the adapter into the Teaching mode.
See Ext_User_Prm_Data_Const(0) Parameter Byte Information for EDT Modules on page 112.
EDT Teaching File Entry
;teaching of the 1794-IF8IH Module
Module = "teach 1794-IF8IH Full format" 0x5C, 0x00;
2251
Ext_Module_Prm_Data_Len = 20
Ext_User_Prm_Data_Const(0) = 0x55, 0x01, 0xA0,
0x00, 0xXX, 0xXX, \
0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, \
0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX
EndModule

Hex	Number of Input Words
00	0 Input words
50	1 Input words
51	2 Input words
52	3 Input words
53	4 Input words
...	...

Hex	Number of Output Words
00	0 Output words
60	1 Output words
61	2 Output words
62	3 Output words
63	4 Output words
...	...

The following table provides byte information for the Ext_User_Prm_Data_Const(0) parameter in the EDT teaching entry.

Example RTD I/O Profile for Sample EDT Module

RTD Index	Assembly Index	Assembly
RTD 0	MSW	Module Status Word
RTD 1	EDT Read Word	EDT Read Word
RTD 2...9	I:0...I:7	RTD Status Data
RTD 10...11	S0:...S1	RTD Status Data
RTD 12	EDT Write Word	EDT Write Word
RTD 13	O:0	RTD Output Word
RTD 14…15	C0:...C1	RTD Configuration Word

Ext_User_Prm_Data_Const(0) Parameter Byte Information[(1)] for EDT Modules

Byte	Definition
1...2	Teaching Key / Module ID.
3...4	Module ID.
5	Module Data Size (0).

Ext_User_Prm_Data_Const(0) Parameter Byte Information[1] for EDT Modules

Byte	Definition
6	Configuration Data Sizes Reserved in Teaching Mode (0).
7	Start address of digital input in bits.
8	Length of digital input in bits.
9	Start address of analog input in bits.
10	Length of analog input in bits.
11	Start address of status information in bits.
12	Length of status information in bits.
13	Start address of digital output in bits.
14	Length of digital output in bits.
15	Start address of analog output in bits.
16	Length of analog output in bits.
17	Start address of configuration in bits.
18	Length of configuration in bits.
19	
20	Special module settings.

(1) See Ext_User_Prm_Data_Const(0) Byte Description and Examples for Non-EDT Modules on page 109 for more details about each byte.

Ext_User_Prm_Data_Const(0) Byte Description and Examples for EDT Modules

Byte	Description	Example
Byte 1...2	Bits 0...12 of the first two bytes are used for Module ID and bits 13...15 must be set to "010" to put the adapter into the teaching mode.	If Module ID of the module is 0x15, 0x01, then first byte is **0x55**. Ext_User_Prm_Data_Const(0) = **0x55**, **0x01**, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX0, 0xXX0, 0xXX
Byte 3...4	Third and fourth bytes of the user module ID that uniquely identifies EDT module and the catalog identity.	If user module ID is **0xA0, 0x00**, then third and fourth bytes is as follows: Ext_User_Prm_Data_Const(0) = 0x55, 0x01, **0xA0, 0x00**, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX0, 0xXX0, 0xXX
Byte 5...6	Always **0x00** in teaching entry.	Ext_User_Prm_Data_Const(0) = 0x55, 0x01, 0xA0, 0x00, **0x00, 0x00**,\ 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\ 0xXX, 0xXX, 0xXX0, 0xXX0, 0xXX
Byte 7	The start address of digital input in bits.	For digital input modules, the start address (in bits) of input (RTD2), based on Example RTD I/O Profile for Sample EDT Module on page 112, is 16(RTD0) + 16 (RTD1) = 32 bits, that is **0x20**. For analog input modules and non-input modules, this byte is **0x00**.

Ext_User_Prm_Data_Const(0) Byte Description and Examples for EDT Modules

Byte 8	The length of digital inputs in bits.	For digital input modules, the length of digital inputs, based on Example RTD I/O Profile for Sample EDT Module on page 112, is **0x80**(I:0 toI:7). For analog input modules and non-input modules, this byte is **0x00**.
Byte 9	The start address of analog input in bits.	For analog input modules, the start address (in bits) of input (RTD2), based on Example RTD I/O Profile for Sample EDT Module on page 112, is 16(RTD0) + 16 (RTD1) = 32 bits, that is, **0x20**. For digital input modules and non-input modules, this byte is **0x00**.
Byte 10	The length of analog inputs in bits.	For analog input modules, the length of analog inputs, Example RTD I/O Profile for Sample EDT Module on page 112, is **0x80**(I:0 to I:7). For digital input modules and non-input modules, this byte is **0x00**.
Byte 11	The start address of Status information in bits.	Based on Example RTD I/O Profile for Sample EDT Module on page 112, the start address (in bits) of Status Information (RTD10) is 16(RTD0) + 16(RTD1) + 128(RTD2…RTD9) = 160 bits, that is, **0xA0**. If there is no Status Information byte in above I/O profile table then this byte is **0x00**.
Byte 12	The length of Status Information in bits.	Based on Example RTD I/O Profile for Sample EDT Module on page 112, the length (in bits) is 32(2 words, S0 .. S1), that is, **0x20**. If there is no Status Information byte in the I/O profile table then this byte is **0x00**.
Byte 13	The start address of digital output in bits.	For digital output modules, the start address (in bits) of output (RTD13) based on Example RTD I/O Profile for Sample EDT Module on page 112, is 16(RTD0) + 16 (RTD1) + 128 (RTD2…RTD9) + 32 (RTD10…RTD11) + 16(RTD12) = 208 bits, that is, **0xD0**. For analog output modules and non-output modules, this byte is **0x00**.
Byte 14	The length of digital output in bits.	For digital input modules, the length of digital output, based on Example RTD I/O Profile for Sample EDT Module on page 112, is **0x10**(O:0). For analog output modules and non-output modules, this byte is **0x00**.
Byte 15	The start address of analog output in bits.	For analog output module, the start address (in bits) of output (RTD13) based on Example RTD I/O Profile for Sample EDT Module on page 112, is 16(RTD0) + 16 (RTD1) + 128 (RTD2…RTD9) + 32 (RTD10…RTD11) + 16(RTD12) = 208 bits, that is, **0xD0**. For digital output modules and non-output modules, this byte is **0x00**.
Byte 16	The length of analog output in bits.	For analog output modules, the length of analog output, based on Example RTD I/O Profile for Sample EDT Module on page 112, is **0x10**(O:0). For digital output modules and non-output modules, this byte is **0x00**.
Byte 17	The start address of Configuration in bits.	Based on Example RTD I/O Profile for Sample EDT Module on page 112, the start address (in bits) of configuration (RTD14) will be 16(RTD0) + 16 (RTD1) + 128 (RTD2…RTD9) + 32 (RTD10…RTD11) + 16(RTD12) + 16 (RTD13) = 224 bits, that is, **0xE0**. If there is no Configuration Information byte in the RTD I/O profile table, then this byte is **0x00**.

Ext_User_Prm_Data_Const(0) Byte Description and Examples for EDT Modules

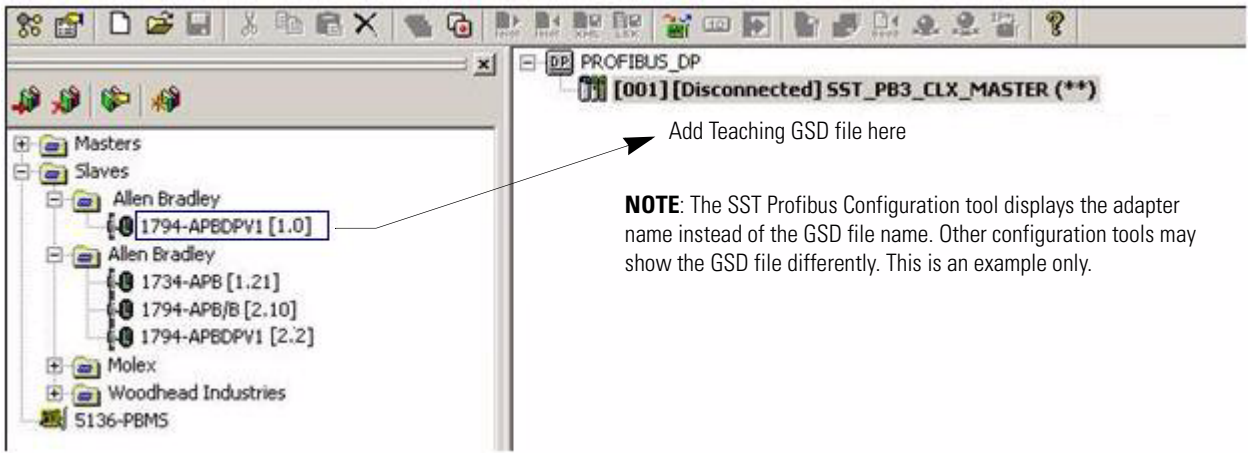
Byte 18...19	The length of Configuration in bits.	Configuration length is specified in two bytes. Based on Example RTD I/O Profile for Sample EDT Module on page 112, the length (in bits) is 32(2 words, C0 .. C1)= **0x00**, **0x20**. If there is no Configuration Information byte in the RTD I/O profile table, then these bytes are **0x00, 0x00**.
Byte 20	Special module settings byte. The adapter supports different types of safe state behavior and other module-specific procedures. This byte defines how the adapter handles the module for teaching.	**Bit 0...3** Reserved (must be set to 0). **Bit 4** 1 = the module supports Cyclic EDT Assemblies. 0 = the module does not support Cyclic EDT Assemblies. **Bit 5** 1 = I/O module must not be configured as CEDT HART I/O module. 0 = I/O module must be configured as CEDT HART I/O module. **Bit 6** 1 = bit 14 of the first write word in RTD (FAULT) is set to enable outputs and is cleared to disable the outputs on the I/O module. 0 = no action on bit 14 of the first write word in RTD. **Bit 7** 1 = bit 15 of the first write word in RTD (RUN) is set to enable the outputs and is cleared to disable the outputs on the I/O module. 0 = no action on bit 15 of the first write word in RTD (RUN). If the I/O module does not support cyclic EDT (that is, bit 4 is 0) and it does not support HART protocol (that is, bit 5 is 1) and no action on bit 14 and 15 of the first write word in RTD (RUN) (bits 6...7 are 0), then this byte is **0x20**.

Teach an I/O Module to Work with 1794-APBDPV1 Adapter

This section describes the step-by-step process on how to make an I/O module work with the 1794-APBDPV1 adapter using the teaching GSD file.

To illustrate the process, the following procedure uses the 1794-OV16P module as an example I/O module. It uses the SST Profibus Configuration tool for configuration.

1. Open the Profibus configuration tool. Load the Teaching GSD file you have created in the previous section (*_teaching.gsd). The file opens up in the left pane of the configuration tool.
2. Drag the Teaching GSD file with "teaching entry" for the 1794-OV16P module from left window pane to the right window pane as shown in the following screenshot.

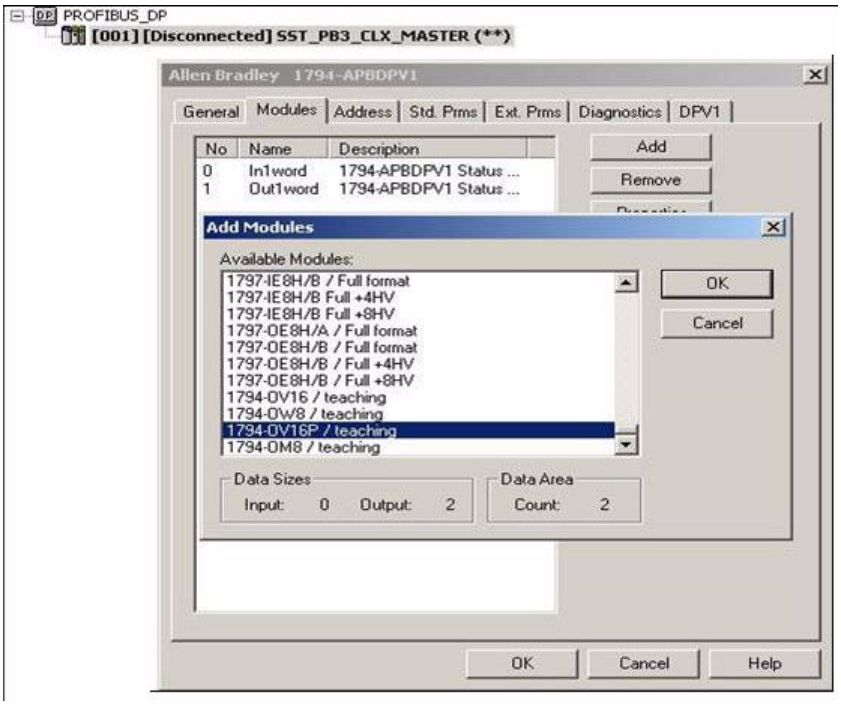


NOTE: The SST Profibus Configuration tool displays the adapter name instead of the GSD file name. Other configuration tools may show the GSD file differently. This is an example only.

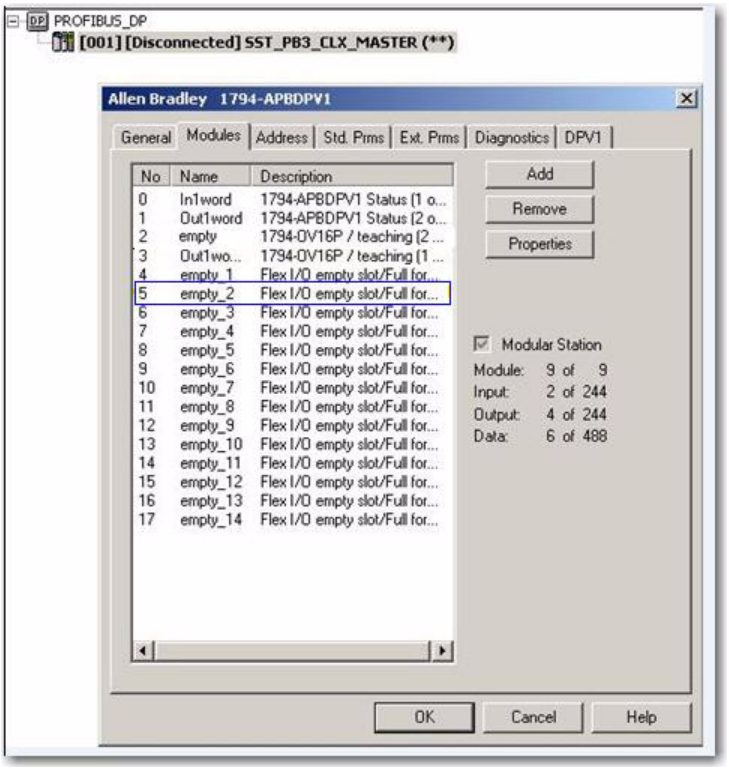
3. Add the adapter status. In the configuration tool, the module name follows the module name specified in teaching entry. For example, if the teaching entry for 1794-OV16P is as follows,

```
;Flex I/O module 1794-OV16P, (default config= 0 word in, 1 word out)
Module = "1794-OV16P / teaching"   0x00, 0x60
;          ********************
2242
Ext_Module_Prm_Data_Len = 17
Ext_User_Prm_Data_Const(0) = 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX,\
                             0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX, 0xXX
```

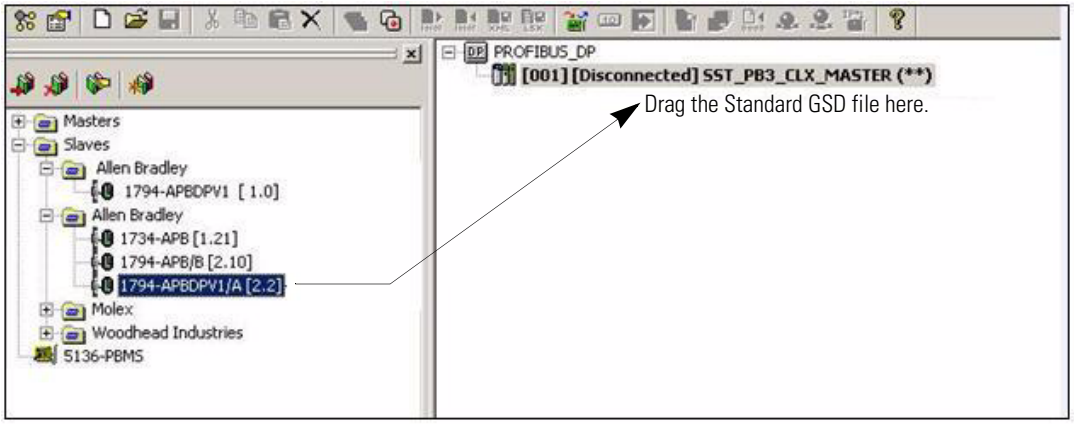
then the module name in the configuration tool module name is "1794-OV16P / teaching", following the name specified in the teaching entry. After adding the adapter status, add the teaching entry "1794-OV16P / teaching" for 1794-OV16P as shown in the following picture.



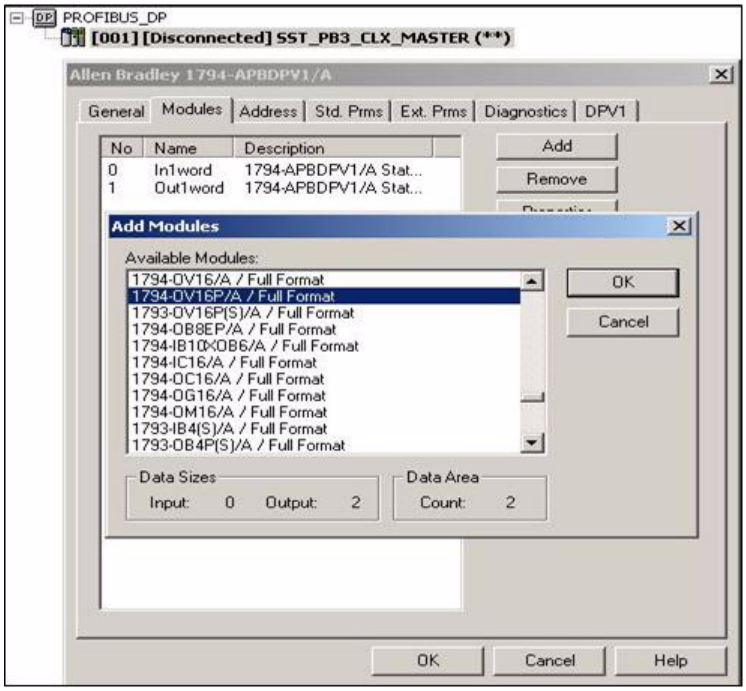
4. If there are remaining slots with modules, add those modules in Full format. If there are no other modules, add the empty slots in Full format as well.
   For example, if 1794-OV16P is in slot 1 and the remaining slots are empty, fill the other empty slots in Full format as shown in the following picture.


PROFIBUS_DP
[001] [Disconnected] SST_PB3_CLX_MASTER (**)
Allen Bradley 1794-APBDPV1
General
Modules
Address
Std. Prms
Ext. Prms
Diagnostics
DPV1
No
Name
Description
0 In1word 1794-APBDPV1 Status (1 o...
1 Out1word 1794-APBDPV1 Status (2 o...
2 empty 1794-OV16P / teaching (2 ...
3 Out1wo... 1794-OV16P / teaching (1 ...
4 empty_1 Flex I/O empty slot/Full for...
5 empty_2 Flex I/O empty slot/Full for...
6 empty_3 Flex I/O empty slot/Full for...
7 empty_4 Flex I/O empty slot/Full for...
8 empty_5 Flex I/O empty slot/Full for...
9 empty_6 Flex I/O empty slot/Full for...
10 empty_7 Flex I/O empty slot/Full for...
11 empty_8 Flex I/O empty slot/Full for...
12 empty_9 Flex I/O empty slot/Full for...
13 empty_10 Flex I/O empty slot/Full for...
14 empty_11 Flex I/O empty slot/Full for...
15 empty_12 Flex I/O empty slot/Full for...
16 empty_13 Flex I/O empty slot/Full for...
17 empty_14 Flex I/O empty slot/Full for...
Add
Remove
Properties
Modular Station
Module: 9 of 9
Input: 2 of 244
Output: 4 of 244
Data: 6 of 488
OK
Cancel
Help

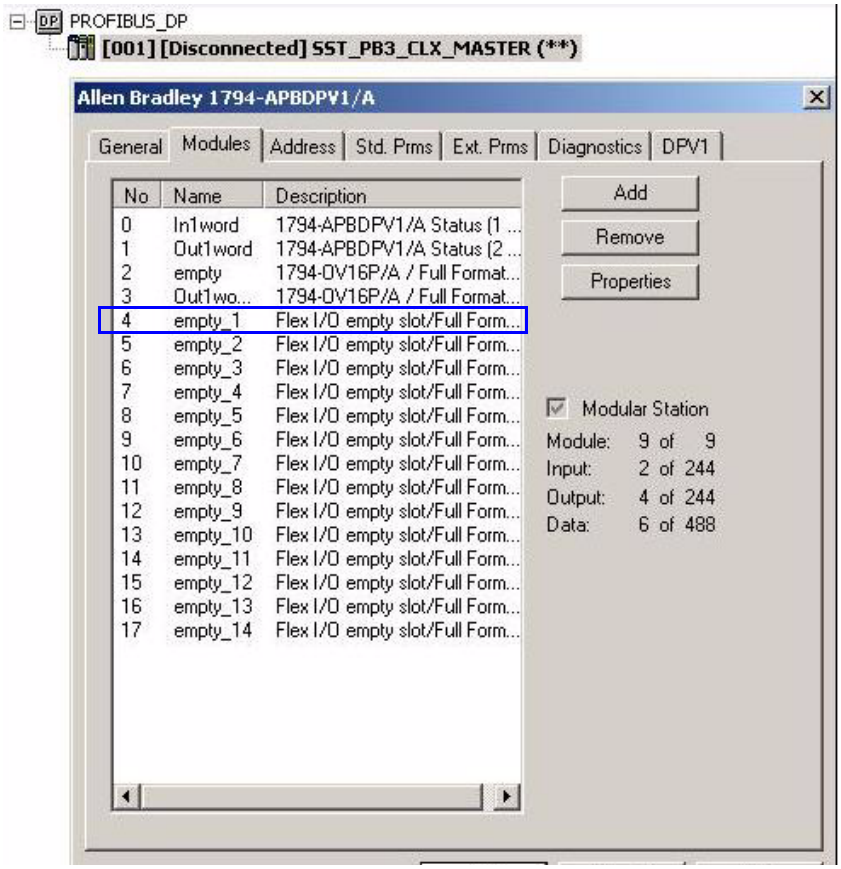
5. Once the modules are added and configured, download the configuration and go online. After the Adapter Status LED and Profibus Status LED light up solid green, then disconnect the connection.
6. Delete the slave (adapter) from the configuration tool right window pane.
7. Now load the Standard GSD (*_standard.gsd) file you have created in the previous section.
8. Drag the standard GSD file from the left window pane to the right window pane as shown in the following picture.



9. Add the adapter status. Then, add standard module 1794-OV16P in Full format as shown in the following picture.



10. If there are remaining slots with modules, add those modules in Full format. If there are no other modules, add the empty slots in Full format as well.
    For example, if 1794-OV16P is in slot 1 and the remaining slots are empty, fill the other empty slots in Full format as shown in the following picture.


PROFIBUS_DP
[001] [Disconnected] SST_PB3_CLX_MASTER (**)
Allen Bradley 1794-APBDPV1/A
General
Modules
Address
Std. Prms
Ext. Prms
Diagnostics
DPV1
No
Name
Description
0 In1word 1794-APBDPV1/A Status (1 ...
1 Out1word 1794-APBDPV1/A Status (2 ...
2 empty 1794-OV16P/A / Full Format...
3 Out1wo... 1794-OV16P/A / Full Format...
4 empty_1 Flex I/O empty slot/Full Form...
5 empty_2 Flex I/O empty slot/Full Form...
6 empty_3 Flex I/O empty slot/Full Form...
7 empty_4 Flex I/O empty slot/Full Form...
8 empty_5 Flex I/O empty slot/Full Form...
9 empty_6 Flex I/O empty slot/Full Form...
10 empty_7 Flex I/O empty slot/Full Form...
11 empty_8 Flex I/O empty slot/Full Form...
12 empty_9 Flex I/O empty slot/Full Form...
13 empty_10 Flex I/O empty slot/Full Form...
14 empty_11 Flex I/O empty slot/Full Form...
15 empty_12 Flex I/O empty slot/Full Form...
16 empty_13 Flex I/O empty slot/Full Form...
17 empty_14 Flex I/O empty slot/Full Form...
Add
Remove
Properties
Modular Station
Module: 9 of 9
Input: 2 of 244
Output: 4 of 244
Data: 6 of 488

11. After adding and configuring the modules, download the configuration and go online. The Adapter Status LED and Profibus Status LED should be solid Green indicating that the adapter recognizes the 1794-OV16P module and works with it properly.

Notes:

Notes:

Additional HART Protocol Information

Overview

This appendix discusses the HART protocol and provides references for additional information about the protocol. The appendix provides:

- HART protocol background information
- Common practice and universal command sets
- Extended command sets
- References to additional information

Message Structure

This section describes the transaction procedure, character coding, and message structure of the HART protocol. These correspond to layer 2, the data-link layer, of the OSI protocol reference model.

Master-slave Operation

HART is a master-slave protocol. This means that each message transaction is originated by the master; the slave (field) device only replies when it receives a command message addressed to it. The reply from the slave device acknowledges that the command has been received, and may contain data requested by the master.

Multiple Master Operation

The HART protocol allows for two active masters in a system, one primary and one secondary. The two masters have different addresses, therefore each can positively identify replies to its own command messages.

Transaction Procedure

HART is a half-duplex protocol; after completion of each message, the FSK carrier signal must be switched off, to allow the other station to transmit. The carrier control timing rules state that the carrier should be turned on not more than 5 bit times before the start of the message (that is, the preamble) and turned off not more than 5 bit times after the end of the last byte of the message (the checksum).

The master is responsible for controlling message transactions. If there is no reply to a command within the expected time, the master should retry the message.

After a few retries, the master should abort the transaction, since presumably the slave device or the communication link has failed.

After each transaction is completed, the master should pause for a short time before sending another command, to allow an opportunity for the other master to break in if it wishes. This way, two masters (if they are present) take turns at communicating with the slave devices. Typical message lengths and delays allow two transactions per second.

Burst Mode (not supported)

To achieve a higher data rate, some field devices implement an optional burst mode. When switched into this mode, a slave device repeatedly sends a data message, as though it had received a specific command to do so. Special commands, 107, 108, and 109, are used to start and stop this mode of operation, and to choose which command should be assumed. If burst mode is implemented, commands 1, 2, and 3 must be supported; other commands are optional. There is a short pause after each burst message to allow a master device to send a command to stop the burst mode operation, or to initiate any other single transaction, after which burst messages will continue.

Generally, burst mode is only useful if there is just one field device attached to a pair of wires, since only one field device on a loop can be in burst mode at any one time. In burst mode, more than three messages can be transmitted per second.

The actual HART message between the FLEX I/O HART module and the field device follows the standard HART messaging protocol.

Preamble	Start Character	Address	Command	Byte Count	[Response Code]	Data	Checksum

Preamble

The preamble is a number of hexadecimal FF characters that precede all frames sent to the HART field device. The size depends on the field devices being used, but it can be from 2 to 32 hexadecimal. The default is 10. The Smart Transmitter Interface inserts the required preamble before each packet or frame transmission to the HART device. This is done automatically so you do not have to program the host processor to do this.

Start Character

The start character of a HART message indicates the frame's format, the source of the message, and if it is using burst mode. The 1794-APBDPV1 module does not support burst mode.

Start Character Byte Definitions

Frame Type	Short Frame Addressing (hex)	Long Frame Addressing (hex)
Master To Slave	02	82
Slave To Master	06	86
Burst Mode From Slave	01	81

HART Address

The Smart Transmitter Interface addresses HART field devices using either a short or long frame address format, as specified by the HART delimiter byte. A short frame address is one byte long. A long frame address is five bytes long and includes a unique 32-bit identifier encoded within each field device by the manufacturer.

HART field device addressing is device dependent. Some devices do not support long frame addressing while others only recognize short frame addressing for HART Command 0. In this situation, use HART Command 0 to determine the long frame address, and then use long frame addressing for al other HART commands. Consult the documentation provided with your field device for details about the addressing formats it supports.

HART Command

This one-byte field specifies the HART command that is to be sent by the Smart Transmitter Interface to the field device. Many commands are device dependent. Consult the documentation provided with your field device for details about the commands supported. Set this field to a device-recognizable command before sending the packet to the Smart Transmitter Interface.

Representative of HART Universal Commands

Universal Command (dec)	Description	Expected Response
0	Read unique indentifier	Unique 32-bit device identifier, revision levels, number of preambles required
1	Read primary variable	Primary variable in floating point (IEEE 754 format)
2	Read primary variable current and percent of range	Primary variable in milliamperes and percents

Representative of HART Universal Commands

Universal Command (dec)	Description	Expected Response
3	Read dynamic variables and primary variable current	Primary variable and up to 4 predefined dynamic variables
6	Write polling address	Assigned polling address - short form
11	Read unique identifier associated with tag	Unique 32-bit device identifier, revision levels, number of preambles required

Byte Count

This one-byte field indicates the number of bytes to follow this field excluding the check byte. Valid values are 0 to 113. Insert the number of bytes required for this packet before transmitting it.

Data

This field specifies a number of data bytes associated with the command number given in the command field. Set the number of data bytes to the appropriate value for the command in question. The valid range is from
0 to 113. Only use this field when writing data to the HART device.

Check Byte

The Smart Transmitter Interface calculates the value of this field and transmits it to the field device as the last byte of a packet. The field device verifies the integrity of the received data packet by checking this byte. Since the Smart Transmitter Interface calculates this byte, you can set this field to a null (00).

Response Code

This two-byte code contains the HART field device status as sent by that device. Field devices detecting a communications error set the most significant bit, bit 7, of the first byte and identify the error in the other seven bits. If the last message was received without error, the field device will clear bit 7 and return a device-dependent response in the other seven bits.

The second byte of this response code returns the operating status of HART field devices. This byte may default to 0 when a communications error occurs as indicated by bit 7 of the first byte being set.

IMPORTANT The host processor ignores any values in the data field when a communications error is detected.

HART Protocol — Communication Error Code

Bit	Error Code	Description
7	Communications Error	If set, the field device has detected a communications error. Bits 0…6 indicate the type of error.
6	Vertical Parity Error	The parity of one or more of the bytes received by the HART field device is incorrect.
5	Overrun Error	At least one byte of data in the receive buffer of the HART field device was over-written before it was read.
4	Framing Error	The stop bit of one or more bytes received by the HART field device was not detected.
3	Longitudinal Parity Error	The longitudinal parity calculated by the HART field device does not match the longitudinal parity byte at the end of the packet.
2	Reserved	Set to 0.
1	Buffer Overflow	The packet is too long for the receive buffer of the HART field device.
0	Undefined	Not defined.

HART Field Device Error Codes

Bit	Error Code	Description
7	Field Device Malfunction	An internal hardware error or failure has been detected by the HART field device.
6	Configuration Changed	A write or set command has been executed by the HART field device.
5	Cold Start	Power has been removed and reapplied, resulting in the reinstallation of the setup information. The first HART command to recognize this condition automatically resets this flag. This flag may also be set following a master reset or self test.
4	More Status Available	More status information is available and can be read using command #48. Read additional status information.
3	Primary Variable Analog Output Fixed	The analog and digital outputs for the primary variable are held at their requested value. They will not respond to the applied process.
2	Primary Variable Analog Output Saturated	The analog and digital outputs for the primary variables are beyond their limits and no longer represent the true applied process.
1	Nonprimary Variable Out of Limits	The process applied to a sensor, other than that of the primary variable, is beyond the operating limits of the device. To identify the variable, use command #48, read additional status information.
0	Primary Variable Out of Limits	The process applied to the sensor for the primary variable is beyond the operating limits of the device.

Universal Commands

Universal Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type	Byte	Data	Type
0	Read unique identifier	—	None	—	0	254 (expansion)	—
					1	Manufacturer identification code	
					2	Manufacturer device type code[1]	
					3	Number of preambles required	
					4	Universal command revision	
					5	Device-specific command revision	
					6	Software revision	
					7	Hardware revision	
					8	Device function flags[2]	(H)
					9…11	Device ID number	(B)
1	Read primary variable	—	—	—	0	PV units code	—
					1…4	Primary variable	(F)
2	Read current and percent of range	—	None	—	0…3	Current (mA)	(F)
					4…7	Primary variable	
3	Read current and four (predefined) dynamic variables	—	None	—	0…3	Current (mA)	—
					4	PV units code	
					5…8	Primary variable	
					9	SV units code	
					10…13	Secondary variable[3]	
					14	TV units code	
					15…18	Third variable	
					19	FV units code	
					20…23	Fourth variable	
6	Write polling address	0	Polling address	—	—	As in command	—

Universal Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type	Byte	Data	Type
11	Read unique identifier associated with tag	0…5	Tag	(A)	0…11	As Command 0	—
12	Read message	—	None	—	0…23	Message (32 characters)	(A)
13	Read tag descriptor, date	—	None	—	0…5	Tag (8 characters)	(A)
					6…17	Descriptor (16 characters)	(A)
					18…20	Date	(D)
14	Read PV sensor information	—	None	—	0…2	Sensor serial number	—
					3	Units code for sensor limits and minimum span	
					4…7	Upper sensor limit	(F)
					8…11	Lower sensor limit	
					12…15	Minimum span	
15	Read output information	—	None	—	0	Alarm select code	—
					1	Transfer function code	
					2	PV/range limits code	
					3…6	Upper range value	
					7…10	Lower range value	
					11…14	Damping value (seconds)	(F)
					15	Write protect code	
					16	Private-label distributor code	
16	Read final assembly number	—	None	—	0…2	Final assembly number	—
17	Write message	0…23	Message (32 characters)	(A)	—	As in command	—
18	Write tag descriptor, date	0…5	Tag (8 characters)	(A)	—	As in command	—
		6…17	Descriptor (16 characters)				
		18…20	Date	(D)			
19	Write final assembly number	0…2	Final assembly number	—	—	As in command	—

(1) Bit 2 = protocol bridge device.

(2) Bit 0 = multisensor device, bit 1 = EEPROM control required.

(3) Truncated after last supported variable.

Common Practice Commands

Common Practice Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type[5]	Byte	Data	Type[5]
33	Read transmitter variables	—	None[2]	—	0	Transmitter variable code for slot 0	—
					1	Units code for slot 0	
					2…5	Variable for slot 0	(F)
					6	Transmitter variable code for slot 1	—
					7	Units code for slot 1	
					8…11	Variable for slot 1	(F)
					12	Transmitter variable code for slot 2[6]	—
					13	Units code for slot 2	
					14…17	Variable for slot 2	(F)
					18	Transmitter variable code for slot 3	—
					19	Units code for slot 3	
					20…23	Variable for slot 3	(F)
34	Write damping value	0…3	Damping value (seconds)	(F)	—	As in command	(F)
35	Write range values	0	Range units code	—	—	As in command	(F)
		1…4	Upper range value	(F)			—
		5…8	Lower range value				(F)
36	Set upper range value (push SPAN button)	—	None	—	—	None	—
37	Set lower range value (push ZERO button)	—	None	—	—	None	—
38	Reset configuration changed flag	—	None	—	—	None	—
39	EEPROM control	0[1]	EEPROM control code	—	—	As in command	—
40	Enter/edit fixed current mode	0…3	Current (mA)[3]	(F)	—	As in command	—
41	Perform device self-test	—	None	—	—	None	—
42	Perform master reset	—	None	—	—	None	—
43	Set (trim) PV zero	—	None	—	—	None	—
44	Write PV units	0	PV units code	—	—	As in command	—
45	Trim DAC zero	0…3	Measured current (mA)	—	—	As in command	—
46	Trim DAC gain	0…3	Measured current (mA)	(F)	—	As in command	—
47	Write transfer function	0	Transfer function code	—	—	As in command	—

Common Practice Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type[5]	Byte	Data	Type[5]
48	Read additional device status	—	None	—	0…5	Device-specific status	(B)
					6…7	Operational modes	—
					8…10	Analog outputs saturated[7]	(B)
					11…13	Analog outputs fixed.[8]	
					14…24	Device-specific status	
49	Write PV sensor serial number	0…2	Sensor serial number number	—	—	As in command	—
50	Read dynamic variable assignments	—	None	—	0	PV transmitter variable code	—
					1	SV transmitter variable code	
					2	TV transmitter variable code	
					3	FV transmitter variable code	
51	Write dynamic variable assignments	0	PV transmitter variable code	—	—	As in command	—
		1	SV transmitter variable code				
		2	TV transmitter variable code				
		3	FV transmitter variable code				
52	Set transmitter variable zero	0	Transmitter variable code	—	—	As in command	—
53	Write transmitter variable units	0	Transmitter variable code	—	—	As in command	—
		1	Transmitter variable units code				
54	Read transmitter variable information	—	Transmitter variable code	—	0	Transmitter variable code	—
					1…3	Transmitter variable sensor serial number	
					4	Transmitter variable limit units code	
					5…8	Transmitter variable upper limit	(F)
					9…12	Transmitter variable lower limit	
					13…16	Transmitter variable damping value (seconds)	
					17…20	Transmitter variable minimum span	
55	Write transmitter variable damping value	0	Transmitter variable code	—	—	As in command	—
		1…4	Transmitter variable damping value (seconds)				

Common Practice Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type[5]	Byte	Data	Type[5]
56	Write transmitter variable sensor serial number	0	Transmitter variable code	—	—	As in command	—
		1…3	Transmitter variable sensor				
57	Read unit tag, descriptor, date	—	None	—	0…5	As in command	(A)
					6…17		
					18…20		(D)
58	Write unit tag, descriptor, date	0…5	Unit tag (8 characters)	(A)	—	As in command	—
		6…17	Unit descriptor (16 characters)				
		18…20	Unit date	(D)			
59	Write number of response preambles	0	Number of response preambles	—	—	As in command	—
60	Read analog output and percent of range	0	Analog output number code	—	0	Analog output number code	—
					1	Analog output units code	
					2…5	Analog output level	
					6…9	Analog output percent of range	
61	Read dynamic variables and PV analog output	—	None	—	0	PV analog output units code	—
					1…4	PV analog output level	(F)
					5	PV units code	—
					6…9	Primary variable	(F)
					10	SV units code	—
					11…14	Secondary variable	(F)
					15	TV units code	—
					16…19	Third variable	(F)
					20	FV units code	—
					21…24	Fourth variable	(F)

Common Practice Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type[5]	Byte	Data	Type[5]
62	Read analog outputs	0	Analog output number code for slot 0	—	0	Slot 0 analog output number code	—
					1	Slot 0 units code	
					2…5	Slot 0 level	(F)
		1	Analog output number code for slot 1		6	Slot 1 analog output number code	—
					7	Slot 1 units code	
					8…11	Slot 1 level	(F)
		2	Analog output number code for slot 2		12	Slot 2 analog output number code	—
					13	Slot 2 units code	
					14…17	Slot 2 level	(F)
		3	Analog output number for slot 3		18	Slot 3 analog output number code	—
					19	Slot 3 units code	
					20…23	Slot 3 level	(F)
63	Read analog output information	0	Analog output number code	—	0	Analog output number code	—
					1	Analog output alarm select code	
					2	Analog output transfer function code	
					3	Analog output range units code	
					4…7	Analog output upper range value	(F)
					8…11	Analog output lower range value	
					12…15	Analog output additional damping value (seconds)	
64	Write analog output additional damping value	0	Analog output number code	—	—	As in command	—
		1…4	Analog output additional damping value (seconds)	(F)			
65	Write analog output range value	0	Analog output number code	—	—	As in command	—
		1	Analog output range units code				
		2…5	Analog output upper range value	(F)			
		6…9	Analog output lower range value				

Common Practice Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type[5]	Byte	Data	Type[5]
66	Enter/edit fixed analog output mode	0	Analog output number code	—	—	As in command	—
		1	Analog output units code				
		2…5	Analog output level[4]	(F)			
67	Trim analog output zero	0	Analog output number code	—	—	As in command	—
		1	Analog output units code				
		2…5	Externally measured analog output level	(F)			
68	Trim analog output gain	0	Analog output number code	—	—	As in command	—
		1	Analog output units code				
		2…5	Externally measured analog output level	(F)			
69	Write analog output transfer function	0	Analog output number code	—	—	As in command	—
		1	Analog output transfer function code				
70	Read analog output end point values	0	Analog output number code	—	0	Analog output number code	—
					1	Analog output end point units code	
					2…5	Analog output upper end point value	
					6…9	Analog output lower end point value	
107	Write burst mode transmitter variables (for Command #33)	0	Transmitter variable code for slot 0	—	—	As in command	—
		1	Transmitter variable code for slot 1				
		2	Transmitter variable code for slot 2				
		3	Transmitter variable code for slot 3				
108	Write burst mode command number	0	Burst mode command number	—	—	As in command	—
109	Burst mode control	0	Burst mode control code (0 = exit, 1 = enter)	—	—	As in command	—

Common Practice Commands

Command		Data in Command			Data in Reply		
#	Function	Byte	Data	Type[5]	Byte	Data	Type[5]
110	Read all dynamic variables	—	None	—	0	PV units code	—
					1…4	PV value	(F)
					5	SV units code	—
					6…9	SV value	(F)
					10	TV units code	—
					11…14	TV value	(F)
					15	FV units code	—
					16…19	FV value	(F)

(1) 0 = burn EEPROM, 1 = copy EEPROM to RAM.

(2) Truncated after last requested code.

(3) 0 = edit fixed current mode.

(4) No a number when fixed output mode.

(5) A = ASCII string (packed 4 characters in 3 bytes).
F = floating point data type (4 bytes) per IEEE 754,
D = date (day, month, year-1900).
B = bit mapped flags.
Unmarked types are 8-, 16-, or 24-bit integers.

(6) Truncated after last requested variable.

(7) 24 bits each.

(8) LSB and MSB return to AO #1…#24.

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